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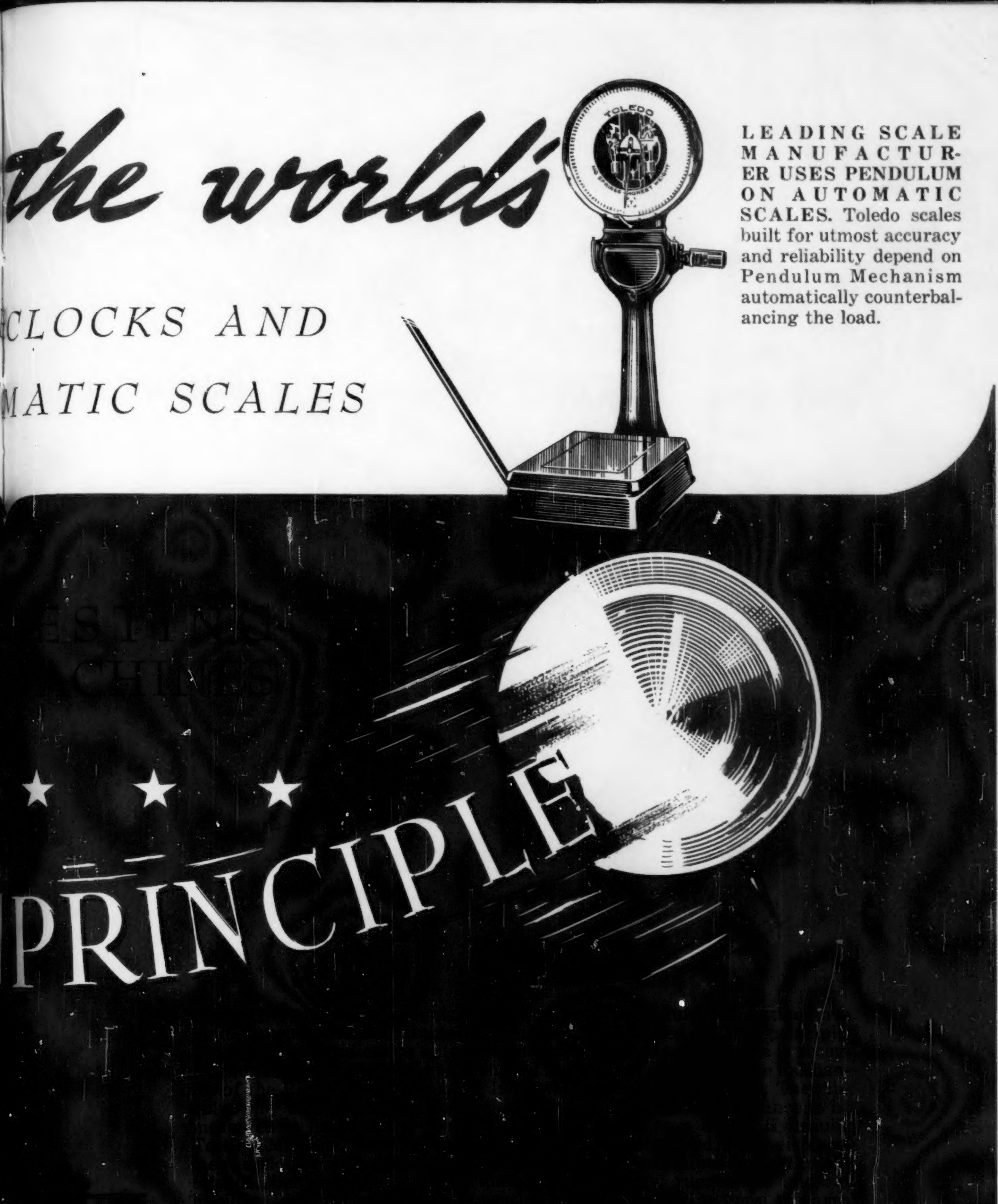

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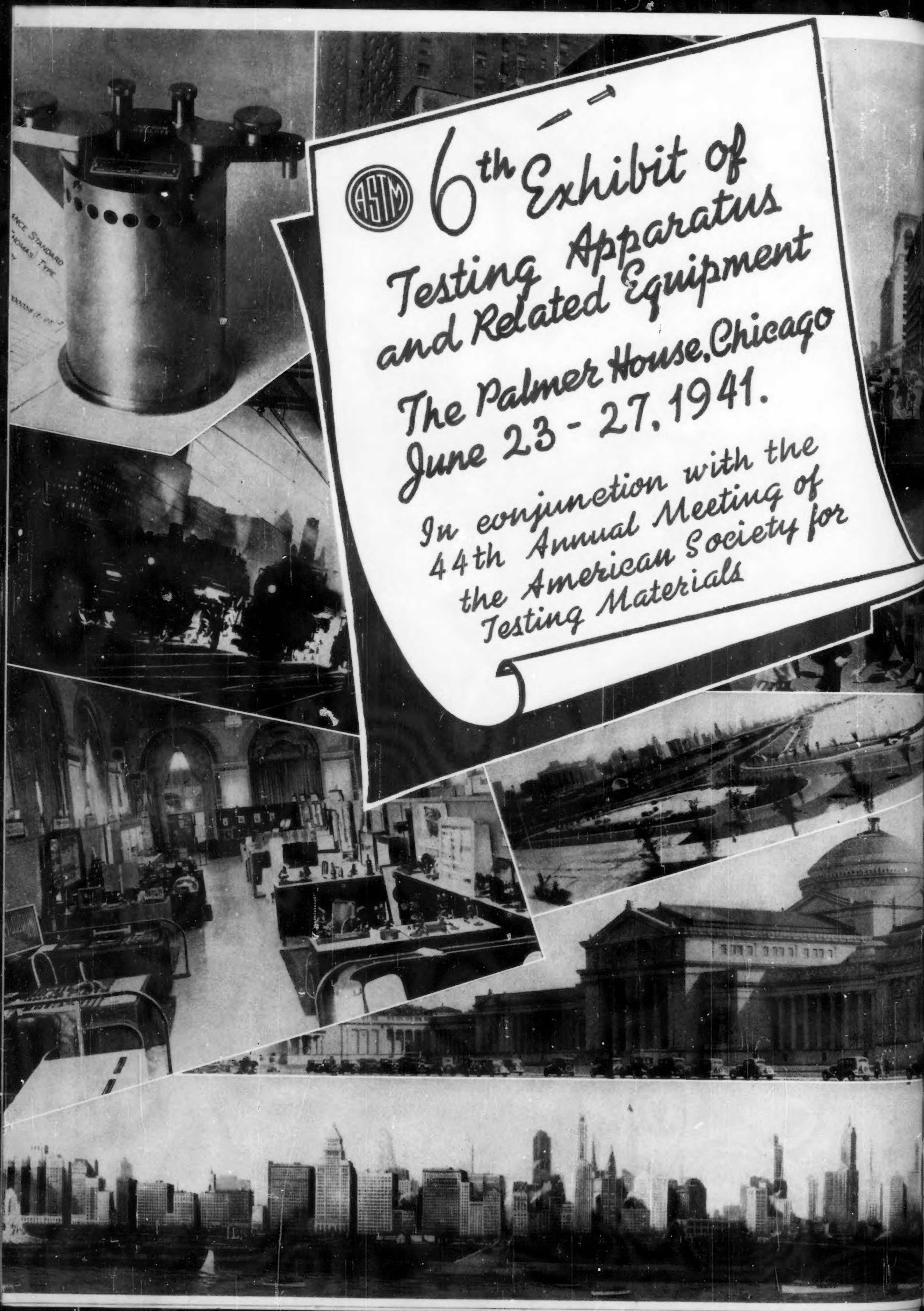
ASTM
6th Exhibit of
Testing Apparatus
and Related Equipment
The Palmer House, Chicago
June 23 - 27, 1941.
In conjunction with the
44th Annual Meeting of
the American Society for
Testing Materials

ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 R. E. Hess, Editor CABLE ADDRESS—TESTING

R. J. Painter, Associate Editor

Number 110 May, 1941

Outstanding Annual Meeting in Prospect Chicago, June 23 to 27

Sixth Apparatus Exhibit and Photographic Exhibit Prominent Features; Strong Technical Program; Local Activities Sponsored by Chicago Committee

VARIOUS ARRANGEMENTS and details for what almost certainly will be one of the Society's outstanding meetings are rapidly nearing completion. As announced, this Forty-fourth Annual Meeting of the Society will be held at The Palmer House, Chicago, June 23 to 27. The Provisional Program is published in this issue and it is particularly significant, since it not only gives an idea of the make-up of the various sessions, but gives synopses of the papers and reports which will be presented. Preprints of as many of the papers and reports as possible will be forwarded to those members who have requested them in advance of the meeting; a Preprint Request Blank is being sent under separate cover to each member in good standing simultaneously with the mailing of this BULLETIN.

Under the sponsorship of the Chicago Committee on Arrangements headed by E. R. Young, Metallurgical Engineer, Climax Molybdenum Co., a number of interesting features are being developed as covered later in this article, including a special session sponsored jointly with the Western Society of Engineers on Tuesday afternoon, June 24, in which papers on subjects of definite local interest will be featured, including a discussion of the subway work, particularly involving materials, with a movie on this feature. Another talk will cover super-highway planning and construction.

A Cocktail Reception is to be arranged by the committee and there will be a number of entertainment features, particularly for the ladies. The Golf Committee is planning to continue last year's successful basic plan.

TECHNICAL PROGRAM

Prominent technical features and sessions at the meeting include the Symposium on Problems and Practices in Determining Steam Purity by Conductivity Methods, with six technical papers. This is sponsored by Committee D-19 on Water for Industrial Uses; Dr. R. E. Hall, Hall Laboratories, Inc., has acted for the committee in making the arrangements.

Two separate technical sessions are necessary to cover the field of non-ferrous metals and it will be noted there are a number of important papers and reports. Because of national defense considerations, the importance of many of the problems to be covered in these sessions has been unparalleled in previous years.

Other prominent sessions cover plastics; steel and effect of temperature; fatigue of metals and corrosion of iron and steel. There are in prospect five important papers covering aspects of plastics and the report of Committee D-20 on Plastics will be noteworthy. This committee has had an extremely extensive research investigative program under way and has been very conscious of the importance of its activities (see Doctor Briggs' statement on the masthead page of this BULLETIN referring to plastics).

The very strong session on steel and effect of temperature includes outstanding reports by Committee A-1 on Steel, with six important new specifications, Committee A-10 on Iron-Chromium-Nickel and Related Alloys, and, in particular, the report of the Joint A.S.T.M.-A.S.M.E. Research Committee on Effect of Temperature on the Properties of Metals which will include the presentation of one of the most important compilations of data the Society will have published, namely, the effect on metals of low temperatures. It will probably not be possible to preprint these data in advance. There are very important papers in the session, one covering the fabrication of carbon-molybdenum steel piping for high-temperature service, another on the effect of spheroidization on carbon-molybdenum steel, and an interesting discussion on a new free-machining addition for stainless steels.

Scheduled for late in the week is the session on concrete and concrete aggregates. An important portion of the

Especially timely in this BULLETIN: Dr. Lyman J. Briggs' trenchant statement on Standardization (p. 36); Material Testing Problems Arising from the Advance in Airplane Performance, by W. B. Klemperer (p. 13); news of the Forty-fourth Annual Meeting (p. 5); and the Provisional Program for the Meeting (pp. 43 to 54).

session will be the presentation in brief form of reports which Committee C-9 on Concrete and Concrete Aggregates is adding to its Report on the Significance of Tests on Concrete and Concrete Aggregates. Discussions will cover size and shape of aggregates, density and unit weight of concrete, mineral composition, permeability and adsorption of concrete. Also to be discussed will be the theoretical effect of dimensions and of method of loading upon the modulus of rupture of beams, and the effect of capping methods and end conditions before capping upon compressive strength of cylinders. Other papers are expected to cover "creep" or "flow" of concrete which is shown to be an elastic action due to nonuniform shrinkage under working load conditions, freezing-and-thawing technique, a device for measuring the plasticity of concrete, and discussion on the sonic methods of testing concrete.

Other prominent sessions will cover iron; road and paving materials, bituminous materials and petroleum; cementitious materials; and building materials.

Opening Session

The formal opening session is scheduled for 10 o'clock, Tuesday morning, all day Monday being reserved for meetings of the Society's technical committees, of which some 200 are expected to be held throughout the week. At this session, the annual address by the President, Dr. W. M. Barr, Chief Chemical and Metallurgical Engineer, Union Pacific Railroad Co., will be presented on a subject with which he has been concerned for a great many years—"Speed, Specifications, and Safety." His active duties and responsibilities in connection with railroad problems, high-speed trains and attendant conditions on one of the most extensive railroad systems in the world, make the subject a particularly pertinent one for him to handle.

Another important address will also feature this meeting, by J. H. Van Deventer, President and Editor, *The Iron Age*, on the subject "Mobilizing Materials for Defense." Mr. Van Deventer is a graduate in mechanical engineering, Cornell University, class of 1903. He was Superintendent of Production and Cost Manager, The Goulds Manufacturing Co., Seneca Falls, N. Y.; later Factory Manager, Buffalo Forge Co.; and in 1914 became Associate Editor, *American Machinist*. For several years he was Editor-in-Chief of this journal and later, Editor, *Industrial Management*, and then Consulting Editor, McGraw-Hill Publishing Co. During World War I he was active in the U. S. Ordnance Dept., Major in the U. S. Army, and afterwards he helped in organizing the Army Ordnance Association.

Edgar Marburg Lecture—Medal Awards

At 4 p.m. on Wednesday afternoon, June 25, Dr. H. L. Fisher, Associate Director, Research Laboratories, U. S. Industrial Chemicals, Inc., will present the Sixteenth Edgar Marburg Lecture on the subject "Natural and Synthetic Rubbers." Further reference to this lecture is made on a succeeding page.

At this time there will also be presented to C. W. MacGregor, Associate Professor of Applied Mechanics, Massachusetts Institute of Technology, the 1941 Charles B. Dudley Medal, awarded in recognition of his outstanding paper on "The Tension Test" presented at the 1940 annual meeting in Atlantic City. The Second Sanford E. Thompson Award, which is presented by A.S.T.M. Committee C-9 on Concrete and Concrete Aggregates to the author of the outstanding paper dealing with concrete and concrete aggregates will be presented in the concrete session, which is scheduled for Friday morning at 10 o'clock.

Preprints Sent on Request

In a separate mailing there is being sent to each A.S.T.M. member in good standing a Preprint Request Blank by which he can request a copy of any of the technical papers and reports preprinted in advance of the meeting. This blank should be returned promptly and should be carefully marked. The Provisional Program in this Bulletin will enable members to make a selection of the items desired. Preprints will be forwarded to the members in three installments. *Members should note that preprints will not be sent unless requested.*

Transportation Reservations Should Be Made Early

Because of the heavy traffic which may be in progress, members should be sure to make their transportation reservations sufficiently early. While there are no special A.S.T.M. convention rates in effect, members may wish to check with their railroad, air lines, and other ticket offices to determine whether any reduced rates are available.

Registration Procedure

Members and visitors should register at the A.S.T.M. desk in the Ballroom Foyer on the Fourth Floor of The Palmer House. Each member will receive his badge, a copy of the final program and preprints of any of the papers and reports desired. The customary members' registration fee of $1 will be in effect. Visitors will receive the badge and program, and may secure preprints for any two sessions of the meeting. The visitor's fee is $1, but if a complete set of preprints is desired they may be procured by the payment of $1 additional.

Hotel Reservations, Advance Registration

It is suggested that all members should make their hotel reservations promptly and for their convenience a reservation card addressed to The Palmer House, requiring no postage, is being sent in a separate mailing. The rates (European plan) at The Palmer House are as follows:

Single	Double Bed	Twin Beds
$3.50	$5.00	$6.00
4.00	6.00	6.50
4.50	6.50	7.00
5.00	7.00	8.00
6.00	8.00	9.00
7.00	9.00	10.00
8.00		11.00

The hotel has some air-conditioned bedrooms which may be available at $5.00 and up, single.

In order to expedite registration of members at the meetings, it is desirable to have as many registration details as possible taken care of in advance and it would be very helpful if members would fill out and mail promptly to A.S.T.M. Headquarters the advance registration card that is being sent.

Chicago Committee on Arrangements and Its Plans

Intensive work directed by Mr. E. R. Young, *Chairman*, Chicago District Committee, Metallurgical Engineer, Climax Molybdenum Co., with the assistance of an executive group consisting of Messrs. J. de N. Macomb, *Vice-Chairman*, Assistant to Vice-President, Inland Steel Co.; C. E. Ambelang, *Secretary*, Engineer, Public Service Co. of Northern Illinois; and J. F. Calef, Chief Chemist, Automatic Electric Co., chairman of the Program Committee, has resulted in an expanded committee, which has been entitled Chicago Committee on Arrangements, with subcommittees organized to be directly responsible for various activities, during the annual meeting. The complete personnel of the Chicago Committee on Arrangements and its subcommittees is as follows:

Chicago Committee on Arrangements

H. H. Morgan, *Honorary Chairman*, Robert W. Hunt Co.
E. R. Young, *Chairman*, Climax Molybdenum Co.
J. de N. Macomb, *Vice-Chairman*, Inland Steel Co.
C. E. Ambelang, *Secretary*, Public Service Co. of Northern Illinois.
Gene Abson, Chicago Testing Laboratory.
H. C. Aufderhaar, Electro Metallurgical Co.
H. P. Bigler, Rail Steel Bar Assn.
R. K. Bowden, Carnegie-Illinois Steel Corp.
W. L. Bowler, The Pure Oil Co.
J. F. Calef, Automatic Electric Co.
A. H. Carpenter, Armour Institute of Technology.
E. E. Chapman, Atchison, Topeka & Santa Fe R. R.
D. S. Colburn, Marquette Cement Mfg. Co.
D. L. Colwell, Paragon Die Casting Co.
H. C. Delzell, Concrete Reinforcing Steel Inst.
E. R. Dillehay, The Richardson Co.
H. B. Emerson, Lehigh Portland Cement Co.
W. B. Floyd, Sears, Roebuck and Co.
H. P. Hagedorn, City of Chicago.
W. C. Hamilton, American Steel Foundries.
R. B. Harper, Peoples Gas Light and Coke Co.
C. J. Hejda, Commonwealth Edison Co.
C. D. Holley, The Sherwin-Williams Co.
G. T. Horton, Chicago Bridge and Iron Co.
C. H. Jackman, Carnegie-Illinois Steel Corp.
A. M. Johnsen, The Pullman Co.
J. J. Kanter, Crane Co.
R. E. Kennedy, American Foundrymen's Assn.
H. B. Knowlton, International Harvester Co.
A. W. Laird, Western Electric Co., Inc.
G. C. MacDonald, Montgomery Ward and Co.
R. F. Main, Acme Steel Co.
L. S. Marsh, Inland Steel Co.
F. R. McMillan, Portland Cement Assn.
H. G. Miller, Chicago, Milwaukee & St. Paul R. R.
H. F. Moore, University of Illinois.
J. E. Ott, Acme Steel Co.
F. A. Randall, Consulting Structural Engr.
J. M. Roberts, Scientific Apparatus Makers of America.
N. C. Rockwood, *Rock Products*.
T. H. Rogers, Standard Oil Co. (Indiana).
C. K. Roos, United States Gypsum Co.
C. G. A. Rosen, Caterpillar Tractor Co.
H. J. Schweim, Gypsum Assn.
L. Skog, Sargent & Lundy, Inc.
A. R. Small, Underwriters' Laboratories, Inc.
G. H. Starmann, Apex Smelting Co.
W. A. Straw, Western Electric Co., Inc.
Paul Van Cleef, Van Cleef Brothers.
H. S. Van Vleet, American Can Co.
C. W. Wheatley, A. O. Smith Corp.
C. C. Zeigler, Swift and Co.

Program Committee

J. F. Calef, *Chairman*, Automatic Electric Co.
Elmer Gammeter, Carnegie-Illinois Steel Corp.
A. W. Laird, Western Electric Co.
G. C. MacDonald, Montgomery Ward and Co.
H. S. Van Vleet, American Can Co.

Finance Committee

J. E. Ott, *Chairman*, Acme Steel Co.
C. E. Ambelang, Public Service Co. of Northern Illinois.
J. F. Calef, Automatic Electric Co.
H. P. Hagedorn, City of Chicago.
J. de N. Macomb, Inland Steel Co.
H. H. Morgan, Robert W. Hunt Co.
C. W. Wheatley, A. O. Smith Corp., Milwaukee, Wis.
E. R. Young, Climax Molybdenum Co.

Entertainment Committee

H. P. Bigler, *Chairman*, Rail Steel Bar Assn.
C. E. Ambelang, Public Service Co. of Northern Illinois.
H. C. Delzell, Concrete Reinforcing Steel Institute.
H. P. Hagedorn, City of Chicago.
L. S. Marsh, Inland Steel Co.
H. J. Schweim, Gypsum Assn.

Apparatus Exhibit Committee

A. H. Carpenter, *Chairman*, Armour Institute of Technology.
W. B. Floyd, Sears, Roebuck and Co.
H. F. Gonnerman, Portland Cement Assn.
C. J. Hejda, Commonwealth Edison Co.
T. C. Poulter, Armour Research Foundation.
T. H. Rogers, Standard Oil Co. (Indiana).
Paul Van Cleef, Van Cleef Brothers.

Publicity and Promotion Committee

J. J. Kanter, *Chairman*, Crane Co.
D. L. Colwell, Paragon Die Casting Co.
H. B. Knowlton, International Harvester Co.
H. H. Morgan, Robert W. Hunt Co.
L. Skog, Sargent & Lundy, Inc.

Photographic Committee

A. W. Laird, *Chairman*, Western Electric Co.
T. C. Bennett, Leeds & Northrup Co.
Cromwell Bowen, Robert W. Hunt Co.
W. F. Crawford, Edward Valve and Mfg. Co.
A. O. Herz, Public Service Co. of Northern Illinois.
J. E. Ott, Acme Steel Co.
E. R. Seabloom, Crane Co.
M. A. Grossman, Carnegie-Illinois Steel Corp.*
Thor Nielsen, Carnegie-Illinois Steel Corp.*

* Representing Committee E-4 on Metallography.

Golf Committee

H. B. Emerson, *Chairman*, Lehigh Portland Cement Co.
R. F. Main, *Vice-Chairman*, Acme Steel Co.
H. P. Bigler, Rail Steel Bar Assn.
J. G. Bragg, Portland Cement Co., Easton, Pa.
W. V. Brumbaugh, National Lime Assn., Washington, D. C.
G. H. Clamer, The Ajax Metal Co., Philadelphia, Pa.
V. A. Crosby, Climax Molybdenum Co., Detroit, Mich.
F. C. Elder, American Steel and Wire Co., Cleveland, Ohio.
H. H. Morgan, Robert W. Hunt Co.
M. R. Paul, National Lead Co., Brooklyn, N. Y.
W. B. Price, Scovill Manufacturing Co., Waterbury, Conn.
F. E. Richart, University of Illinois, Urbana, Ill.

Committee on Information

W. A. Straw, *Chairman*, Western Electric Co.
H. C. Aufderhaar, Electro Metallurgical Co.
E. R. Dillehay, The Richardson Co.
O. W. Storey, Burgess Labs.
G. E. Stryker, Bell & Howell.

Membership Committee

C. H. Jackman, *Chairman*, Carnegie-Illinois Steel Corp.

Ladies' Entertainment Committee

Mrs. E. R. Young, *Chairman*.
Mrs. C. E. Ambelang.
Mrs. H. P. Bigler.
Mrs. J. F. Calef.
Mrs. A. H. Carpenter.
Mrs. E. E. Chapman.
Mrs. D. L. Colwell.
Mrs. H. B. Emerson.
Mrs. R. B. Harper.
Mrs. C. H. Jackman.
Mrs. A. M. Johnsen.
Mrs. J. J. Kanter.
Mrs. A. W. Laird.
Mrs. J. de N. Macomb.
Mrs. F. R. McMillan.
Mrs. H. H. Morgan.
Mrs. J. E. Ott.
Mrs. F. A. Randall.
Mrs. T. H. Rogers.
Mrs. W. A. Straw.
Mrs. Paul Van Cleef.

Preliminary Entertainment Plans

The Chicago Committee has definite plans in mind for entertainment of the members of the Society and their families during the annual meeting. Under Mr. Bigler's direction the Chicago Committee will be hosts at a cocktail reception immediately following the Marburg Lecture program, when all members, guests, and ladies will have an opportunity to meet the outgoing and incoming officers and other celebrities of the Society.

On Wednesday evening, when no technical session is planned, the Exhibit will feature Officers' Night, when the officers of the Society and the members of the Chicago Committee on Arrangements will make it a special point to visit the Exhibit. At this time the exhibitors will plan special demonstrations.

Related directly to the Entertainment Program is the Golf Tournament which is being arranged by a committee headed by H. B. Emerson, Lehigh Portland Cement Co. As announced in an accompanying article, the committee plans to follow last year's successful tournament, by which

it is possible for A.S.T M. golfers and visitors to play on any day throughout the week, rather than at a specified time as has been the previous plan. All golfers are urged to bring their clubs and a grim determination to capture one of the excellent prizes which the committee will award. The A.S.T.M. Golf Cup which is awarded for one year to the member with low gross score in the Tournament will be up for competition.

Ladies' Entertainment Program

Under the direction of Mrs. E. R. Young, the Ladies' Entertainment Committee is planning to make the stay of the members' wives and families interesting. Chicago affords a variety of things to do and to see which should meet almost any taste and inclination. The committee is planning on a bridge-luncheon, shopping trips, and sightseeing tours, and further details of these will of course be furnished the members for transmission to their families. In another article in this Bulletin, there are described very briefly some of the interesting points in Chicago, and Mrs. Young and her associates will have in mind those features which would appeal most to the ladies. To an increasing extent in recent years, the members have been bringing their wives and families to the meetings and the ladies can be assured of an interesting stay in Chicago.

Other Committees

Many of the plans of the Chicago Committee with respect to entertainment and related activities bear directly on the work of the Finance Committee which is headed by J. E. Ott, Acme Steel Co. Mr. Ott and his committee plan to contact various interests in the Chicago group.

The Publicity and Promotional Committee headed by J. J. Kanter, Crane Co., has several specific plans in mind to stimulate interest in the meeting and attract the attention particularly of local technical men and engineers concerned with materials fields. This group will cooperate with C. H. Jackman, Carnegie-Illinois Steel Corp., who is chairman of the Membership Committee.

H. L. Fisher—Marburg Lecturer

Natural and Synthetic Rubbers

H. L. Fisher

Dr. Harry L. Fisher, Director of Organic Research, U. S. Industrial Chemicals, Inc., Stamford, Conn., will deliver the Sixteenth Edgar Marburg Lecture at the Society's annual meeting in Chicago on Wednesday afternoon, June 25. An outstanding authority in his field, Dr. Fisher plans to cover in detail a number of very important aspects of this general subject.

In connection with the scope of the lecture, he has submitted the following statement:

"Rubber is a very versatile material and now that its 'life' has been lengthened, its interesting and varied properties are making possible the enormous extension of its usefulness. Even though the greatest use of rubber is in tires and tubes for automobiles, more and more rubber is being used in the structural parts of the automobile, and, in fact, today the unique properties of rubber are literally forcing its use in structures of all kinds of products.

"Natural rubber has certain drawbacks and is meeting competition on a quality basis from the new synthetic rubbers. Synthetic rubber compounds show greater resistance than natural rubber compounds to the action of oils and greases, air and sunlight, the coronal discharge, heat, and sometimes to abrasion. The chemistry and physics and the methods of compounding these interesting materials are briefly discussed and compared with those of natural rubber.

"Vulcanization of both natural and synthetic rubbers is also discussed as well as the meaning of the term rubber, the use and advantages of latex, hard rubber and reclaimed rubber."

Following his education at Williams College, A.B., 1909; and Columbia University, A.M., 1910; Ph.D., 1912, Doctor Fisher was Instructor in Organic Chemistry at the latter institution until 1919. Then for seven years he was Research Chemist at The B. F. Goodrich Co., Akron, Ohio, and for the next ten years, until 1936, he was Research Chemist with the U. S. Rubber Co., General Laboratories, New York City and Passaic, N. J. Since 1936 he has been in his present position.

Dr. Fisher is the author of about 30 patents chiefly in the field of rubber technology (rubber isomers used in the vulcalock process for attaching rubber to metal, rubber accelerators, rubber derivatives, nonsulfur vulcanization, etc.). He has been a prolific writer of technical articles, particularly in respect to chemistry and technology of rubber. He is the author of two books entitled "Laboratory Manual of Organic Chemistry," and "Rubber and Its Use."

He is President of the American Institute of Chemists and Chairman of the Western Connecticut Section of the American Chemical Society. Formerly he was Chairman of the Akron Section and of the Rubber Division; also Secretary of the Organic Division.

The field of rubber and rubber products is one in which the Society has been extremely active, particularly through the work of its Committee D-11 on Rubber Products. This committee has developed a large number of widely used specifications and tests and has sponsored the development of important data on the properties and tests of rubber and its products.

A.S.T.M. Golf Tournament at Chicago Meeting

THE COMMITTEE IN charge of the 1941 Golf Tournament which will be held during the annual meeting in Chicago, has issued a clarion call to all A.S.T.M. golfers to be sure to bring their clubs with them to the annual meeting. This is intended to reach all good, mediocre, and "not too good" golfers.

Since there was revived interest in the 1940 Golf Tournament in Atlantic City which involved an important innovation, namely, making it possible to play on any day of the week instead of at one specified time, the Chicago Committee will continue this procedure. From the list of personnel of the Chicago Committee on Arrangements, it will be seen that the tournament is to be arranged by a committee with H. B. Emerson, *chairman*, Lehigh Portland Cement Co., and R. F. Main, *vice-chairman*, Acme Steel Co. The various members of the committee from outside of Chicago will assist the local group in promoting the tournament and stimulating interest in their respective territories. Depending upon the entries, the committee may arrange for some kind of geographic competition.

The committee will make arrangement for play at the Glen Oak Country Club, which can be reached very conveniently by the Aurora and Elgin, an electric line with a station just adjacent to the Glen Oak grounds. There is a station in Chicago very conveniently located to The Palmer House in the Loop district so that the transportation problem is well taken care of.

The greens fee at Glen Oak is $2 per person, and the committee will take care of this feature with tickets which each member can obtain in advance at the A.S.T.M. desk. All other expenses at the club can be handled by cash payment. Tickets can be signed during the day for such expenses as food, refreshments, and caddy fees, payment to be made before leaving the club.

The committee plans to work out a method of distributing prizes at the conclusion of the tournament rather than at the end of the play on each day. This is desirable because of the fact that the club is not so near the meeting center as is the case in Atlantic City.

All golfers will be interested to note that the Chicago Committee on Arrangements plans to contribute the tournament prizes, and on this basis the only expense to the golfers is the greens fee, transportation, and personal expenses at the club.

Further details of the tournament will be announced and Messrs. Emerson, Main, and their associates will be on hand at the annual meeting to take care of all matters in relation to the Golf Tournament.

Sixth Exhibit of Testing Apparatus and Instruments

Many New Developments in Scientific Apparatus and Laboratory Supply Fields to Be Demonstrated

A LARGE NUMBER of new instruments and apparatus related to many phases of the engineering materials field will be on display in the Society's Sixth Exhibit of Testing Apparatus and Related Equipment being held during the A.S.T.M. annual meeting, The Palmer House, Chicago, June 23 to 27, inclusive. Several interesting items will be on display for the first time.

It will be noted from the general descriptions of the displays which appear below that a very wide range of instruments and machines and supplies for testing, analysis, research, and investigations in the field of materials, and products, will be demonstrated.

In addition to these exhibits of commercially available apparatus, certain committees of the Society will sponsor displays including the following: C-7 on Lime; D-1 on Paint, Varnish, Lacquer, and Related Products; E-4 on Metallography; and E-7 on Radiographic Testing. These displays by Society committees will feature various research activities and will serve to acquaint those attending the Exhibit with some of the problems confronting the various groups and methods of attacking them.

There will also be a number of research exhibits featuring special apparatus, testing techniques, and related work, which is being carried out by various research laboratories—inter-society, governmental, industrial and educational. For instance, the Welding Research Committee of the Engineering Foundation plans displays of various phases of its work which are of direct interest in the field of materials. The Committee on Welding Stresses will cover its studies on the behavior of hollow specimens under bi-axial repeated tension stresses, showing the design of machine and some preliminary results; and the fatigue committee, working on 8-in. wide specimens under repeated tension and compression, will show a specimen and some results of tests. The group concerned with resistance welding plans to include a display of some of its work involving spotwelding of sheet aluminum and steel sheets.

The U. S. Bureau of Mines will have an interesting display on the causes and prevention of caustic embrittlement in steam boilers, featuring two types of embrittlement detectors. They will also demonstrate new and approved physical apparatus for the quick analysis of open-hearth steel slags and for the testing of steel. There will also be shown special apparatus for obtaining samples of oil-bearing sands from oil wells which show the distribution of liquid and vapor phases of hydrocarbons.

EXHIBIT SIGNIFICANT

Since its inception in 1931 in connection with the annual meeting held in Chicago, the Exhibit has become a feature of the meetings held in the odd-numbered years; it has come to be considered an important feature of these meetings focusing attention as it does on important new developments in this field, on the wide range of standard equipment available for carrying out tests, and giving the

leading companies in the apparatus and laboratory supplies fields an opportunity to demonstrate progress they have made, not only with standard equipment, but with many other important instruments. There is, of course, a great variety of apparatus used in investigating materials which is not standardized by A.S.T.M., and the manufacturers rightly stress many such items.

The Exhibit will be held in the Exhibition Hall of The Palmer House which is on the Fourth Floor immediately adjacent to the A.S.T.M. Registration Headquarters. On this floor are the Grand Ballroom and Red Lacquer Room, which will be used for the Technical Sessions, so that the various features of the meeting will be centralized.

List of Companies in Instruments and Related Fields, with Brief Notes on Displays

Atlas Electric Devices Co., Inc. Chicago, Ill.

The basis of a two-booth display being featured by this company will be the three types of Atlas meters: Fade-Ometer, Launder-Ometer, and Weather-Ometer. Various applications of these instruments and other items will be demonstrated.

Baldwin-Southwark Corp. Philadelphia, Pa.

Outstanding attraction at the Baldwin-Southwark exhibit is expected to be the company's new SR-4 bonded metalectric strain gages.

Capable of reading static strains down to 15 psi. in steel and frequencies to over 30,000 cycles per second, the gages were first introduced last year. Recent improvements include the development of a temperature compensated gage for application to curved surfaces and an improved strain rosette for two-dimensional stress analysis.

Christian Becker, Inc. New York, N. Y.

This display will comprise a full line of Christian Becker analytical balances and torsion laboratory scales. Included among the Christian Becker balances will be the popular dial reading Chainomatic analytical balances, micro balances, magnetically damped balances, keyboard balances, etc. A feature of particular interest will be the projection reading analytical balance.

Torsion balances for laboratory work in the dairy, drug, chemical, and textile industries will be on exhibit.

W. H. & L. D. Betz Philadelphia, Pa.

This company will exhibit the new Straub type degassing condenser for removal of noncondensable gases from steam for conductivity determinations. They will also show water testing equipment for plant and laboratory control tests, including the new "M" Test Kit, a complete portable water testing laboratory in itself. A new Solu-bridge for conductivity determinations of both condensate and boiler water will also be exhibited. The exhibit will be in charge of the Chicago office of W. H. & L. D. Betz, with men from the Philadelphia office also in attendance.

Brabender Corp. Rochelle Park, N. J.

The Plastograph (Recording Plastometer) measures consistency over a wide range of pliable material. Has been applied in research and plant control on such materials as: unvulcanized rubber, celluloid, rayon, activated carbon, paints, fertilizer, starch, etc. The Brabender semi-automatic moisture tester will be featured also. This is a combination of drying oven and analytical balance.

The pressure thermostat, a central thermostatic unit capable of feeding an entire laboratory requirement of temperature controlled water baths is to be on display. Also the Brabender viscograph, capable of measuring and recording viscosities at a constant rate increase of temperature, from room temperature up to 150 C.

Adolph I. Buehler Chicago, Ill.

In this booth will be displayed various types of optical instruments for testing and research and other equipment including a selection from the following list: measuring, polarizing, and Brinell microscopes; metallographs; spectrographs; titrators; carbon-meters; cutters; grinders; polishing apparatus. Among the features will be the AB micro hardness tester.

Canadian Radium & Uranium Corp. New York, N. Y.

Great progress has been made in recent years in the application of radiography to industrial needs and, in this development, the use of radium (gamma-ray radiography) has played a large part. The Canadian Radium & Uranium Corp. represents Eldorado Gold Mines Ltd., Toronto, the world's largest producers of radium and the only producer in the Western hemisphere. This high-purity Canadian radium is now offered the metal industry in approved containers for gamma-ray radiography. Our representatives will be prepared to discuss your individual problems.

Central Scientific Co. Chicago, Ill.

This company will again feature a number of new developments in the laboratory field. Included among these will be the unique Cenco-Meinzer sieve shaker; a new high-torque cone-drive motor stirrer; the Cenco-Menzel autoclave for accelerated soundness tests on cement; the Cenco grating spectrograph for qualitative and quantitative analysis; a new magnetic damping device for analytical balances; a hammer-type pulverizing mill; and many other developments of interest in the testing, analysis, and research on engineering materials.

Coleman Electric Co. Maywood, Ill.

This display will consist of a complete line of glass electrode pH electrometers, ranging from the low cost and especially rugged industrial tester to the high precision laboratory instruments. All of these employ the factory sealed glass electrode which is almost universal in its application.

In addition to pH equipment, Coleman will exhibit two models of spectrophotometers, including the newly introduced Universal spectrophotometer with its ultraviolet illuminator which adapts it for vitamin assay and other work with fluorescent materials. Also on display will be the new Model 12 electronic fluorophotometer, designed for special application in the field of vitamin study.

Eastman Kodak Co. Rochester, N. Y.

Some few months ago, this company announced a new product—Eastman industrial x-ray films. These were specifically designed to meet the requirements of those engaged in the detection of internal flaws in manufactured articles either by x-rays or gamma radiation. Radiographs of this work will be displayed and our representatives will be very glad to discuss the use of this film in these testing methods.

Federal Classifier Systems, Inc. Chicago, Ill.

Laboratory air classifying instruments for separating ground material according to particle size will be displayed. The latest design incorporates graduated valves for controlling air volume, air pressure, and mesh, this device serving actual production as well as research. These classifiers are widely used by the plastic industry, in powder metallurgy and in numerous other important industries. Operates from any lighting socket. The precision characteristics of the instruments will be demonstrated.

Gaertner Scientific Corp. Chicago, Ill.

Among the instruments and precision apparatus which will be displayed by this company are spectrographs and kindred equipment, toolmakers microscopes, precision optical bench, interferometers, and other items of definite interest in testing and research in materials.

The Emil Greiner Co. New York, N. Y.

This display will feature the Diller photoelectric colorimeter for determining the color of petroleum products. This gives color in a continuous scale of all the various fractions of petroleum, simplifies and speeds up the test, and can be handled by operators without any special technical training. It is planned to exhibit the Mac Coull tester for the corrosion effect of internal combustion lubricants in contact with standard alloy bearings, particularly for airplane engines. This instrument provides a practical means for evaluating and grading these oils in the laboratory. Other items will include instruments for the aniline point test, grease melting point apparatus, etc.

Humboldt Manufacturing Co. Chicago, Ill.

This company, manufacturers of a wide range of testing instruments and equipment used in investigating materials, will undoubtedly display certain of its products of particular interest to A.S.T.M. members including testing sieves, asphalt testing equipment, apparatus for analysis of concrete, testing molds, and such items.

Illinois Testing Laboratories, Inc. Chicago, Ill.

Typical items of this company's line will be demonstrated, including indicating and controlling pyrometers, including portable types, resistance thermometers in both portable and mounted types, and the instantaneous direct reading air velocity meter known as the Velometer. Of particular interest to A.S.T.M. members will be the improved "Alnor" Pyrocon for surface temperature measurements. New features provide for complete interchange by thermocouple without any change in the instrument calibration, also the quick detachability feature of the connector arm and the interchangeability between the rigid and flexible arm. This instrument is used for readings of revolving rolls, molds, platens, and other surfaces, also plastic material temperatures and general research work.

Instrument Specialties Co., Inc. Little Falls, N. J.

The first public showing of the electronic micrometer "pressureless" measuring instrument with a sensitivity to differences as small as five millionths of an inch will be a feature of the display being prepared by this company. The measuring devices to be displayed will include instruments designed specifically for precision measurements of soft or compressible materials such as rubber, paper, felt, fabrics, and plastics. Also featured will be an instrument for measuring diameter, out-of-round and enamel thickness of insulated wire.

Kimble Glass Co. Vineland, N. J.

The Kimble Glass Co.'s 1941 Exhibit will include laboratory glassware used in many A.S.T.M. methods of test; also on display will be a representative selection of apparatus from the complete Kimble line.

At this time there will also be on view samples of Ŧ ground apparatus. All Kimble ware now provided with Ŧ stoppers, stopcocks, and joints.

Lancaster Iron Works, Inc. Lancaster, Pa.

Lancaster mixers will be the principal theme of the display, with several operating stock models, including the recently developed laboratory Model TM. Two other stock models recommended for control and small batch production work, each larger in size, respectively, will also be on display.

There will also be shown a scale model of the 9 cu. ft. Lancaster mixer, Symbol EAG-4. This unit is unique since it comprises every detail that applies to a standard full size production machine, including the popular central discharge valve mechanism. All of these Lancaster mixers employ the same scientific countercurrent mixing action that has established so substantial a reputation for precision in dry or damp, soft and stiff kneadable, or slurry consistencies.

Leeds & Northrup Co. Philadelphia, Pa.

Delegates and visitors to the A.S.T.M. annual meeting will have a chance to see two new pieces of testing equipment at L&N's booth. Of particular interest is the new thermocouple checking furnace and equalizing block which enables you to check thermocouples within ±1 F. from room temperature to 1000 F. Also on display for the first time will be L&N's convenient new glass electrode pH indicator.

Other equipment shown will include a type K2 potentiometer, a potentiometer-type optical pyrometer, a Schering Bridge, and the accurate universal pH indicator.

"Metals and Alloys" New York, N. Y.

Exhibiting *Metals and Alloys*, "The Magazine of Metallurgical Engineering," which has had a steady increase in paid circulation during the past twelve months. The total monthly net paid circulation now stands at over 10,000 copies. The publishers will also exhibit a number of technical and engineering books of interest to testing engineers.

National Carbon Co., Inc. Cleveland, Ohio

The exhibit of National Carbon Co., Inc., will include an interesting demonstration of its Accelerated Weathering and Fading Units. The machines will be in operation and samples of results will be shown. This will be one of the first demonstrations of the new Model XV Accelerated Fading Unit, a testing machine with many novel features.

Parr Instrument Co. Moline, Ill.

Featured in this display will be a complete assortment of Parr reaction bombs and accessories for various test purposes. Three different styles of oxygen combustion bombs and six different sodium peroxide combustion bombs will be shown. Extreme pressure reaction equipment will be displayed, including a hydrogenation bomb capable of handling gas pressures up to 6000 psi. at 400 C. An adiabatic calorimeter together with other new and improved items of Parr apparatus will also be demonstrated.

Precision Scientific Co. Chicago, Ill.

This company will show in addition to a timely selection of A.S.T.M. apparatus for testing cement, lime, gypsum and petroleum products—several new developments never before exhibited.

These will include the Motor-Matic grease worker, the S.I.L. Mobilometer, a new rapid setting differential thermometer, an automatically controlled low-temperature storage cabinet, and an approved assembly of their patented Front-View petroleum distillation apparatus recently approved by the Society.

Two booths have been reserved to accommodate an imposing array of modern laboratory utilities.

Radium Chemical Co., Inc. New York, N. Y.

Radium Chemical Co., Inc., will display radiographs taken by radium. The equipment used in radium-radiography will be demonstrated by the representatives in attendance, and you are cordially invited to visit this booth.

Riehle Testing Machine Division, American Machine and Metals, Inc. East Moline, Ill.

Intends to exhibit improved extensometers, elongation percentage gages, and a number of small testing machines, among which a new Brinell tester and a motor operated cement tester will be especially interesting because their design departs rather radically from conventional models.

The new Brinell tester is known for extremely smooth application of load and means are incorporated to reduce inertia and frictional errors.

E. H. Sargent and Co. Chicago, Ill.

Featuring the display of this company will be the Heyrovsky polarograph, an instrument of widespread application in the field of materials. Other selected items will be made from the wide range of materials it handles, including glassware, metalware, precision instruments, and equipment used in fields of chemistry, physical testing and the like.

Schaar and Co. Chicago, Ill.

This company's exhibit will feature the Lumetron photoelectric colorimeter and fluorescence meter. This is a machine of great value in the analysis of vitamins, in the measurement of fluorescence, and in general colorimetric analysis. The accuracy and reproducibility of the measurements make the instrument a most valuable laboratory tool. Also included in the exhibit will be complete equipment for the laboratory, such as glassware, reagents, analytical balances, pH meters, and many types of scientific instruments.

C. J. Tagliabue Manufacturing Co. New York, N. Y.

This company, makers of indicating, recording, and controlling instruments, will have an interesting display of many new and improved instruments for testing materials, including the following recent developments: Tag celectray throttling indicating controller for creep test furnaces; the new vibration-proof celectray indicating controller which is sensitive to temperature change but not sensitive to vibration; and the Celectray multiple point temperature recorder. The new Tag-Heppenstall moisture meter, "dielectric" type which supplements our present line of Tag-Heppenstall moisture meters for grain, lumber, tobacco, etc., and extends the field of moisture measurement by electrical instruments to solutions and powders. Tag new and improved petroleum testing equipment for acid heat, gum stability, Ramsbottom carbon residue, grease consistency, kinematic viscosity, flash and fire, etc.

Wilson Mechanical Instrument Co., Inc. New York, N. Y.

In addition to the Rockwell hardness tester and the Rockwell superficial hardness tester in the latest models, there will be in operation the Tukon tester for determination of the Knoop hardness number. This tester offers a new method of testing which requires minute, high precision penetrators and optical measurement of indentation, because only by such method is there at present any hope for high precision hardness tests on very thin or brittle or shallow surface conditions that require still smaller indentations and still lighter loads than are possible even with the Superficial model of our Rockwell tester.

The Tukon tester, under selected weights, applies loads that may be varied from 0.1 kg. to 3.5 kg. The tester is fully automatic under electronic control in a synchronous cycle.

Photographic Exhibit

THROUGHOUT THE WEEK of the annual meeting at The Palmer House there will be in progress the Fourth Photographic Exhibit and Competition. This is being developed by a local committee headed by A. W. Laird, Metallurgical Engineer, Western Electric Co. Committee E-4 on Metallography in its part of the exhibit is sponsoring a display of photomicrographs.

The general theme of the photographic exhibit this year is "Materials, Testing and Research" with special emphasis on the human element or personnel factors.

Full details of the exhibit are now available in the form of a descriptive entry blank and copies will be mailed on request. Each member of the Society and committee member is receiving an entry blank in a separate mailing concurrently with the mailing of this BULLETIN.

A cordial invitation is extended to all A.S.T.M. photographers, whether nonprofessional or professional, to participate. Committee E-4 is very anxious that there be a wide selection of photomicrographs not only in the field of metallography but pertaining to other materials and solicits entries.

The Palmer House

A GREAT CITY has literally grown up around the Palmer House in Chicago. Originally opened thirteen days before the historic Chicago Fire in 1871, the old hotel was immediately rebuilt as the first fireproof hotel in the world. The hotel's builder and owner, Potter Palmer, actually offered a five thousand dollar challenge to anyone who could start a fire in any guest room and cause it to go farther than the room in which it began. (One such test was made.)

The so-called "new hotel," opening during Christmas Week in 1925, at the corner of State, Monroe, and Wabash Sts., is still owned and operated by the heirs of the original Mr. Palmer. It is the largest hotel building in the world from the standpoint of cubic feet of contents and of floor area.

Eighty thousand square feet of convention, meeting, dining and exhibition space are concentrated on a single floor alone. This includes the Grand Ballroom, the Red Lacquer Room, and the Exhibition Hall on the fourth floor, which will be the center of the A.S.T.M. meeting. On the floor beneath and on three floors above and about this vast concentration of convention space are located 32 other meeting and dining rooms.

The murals in the famed Chicago Room are more than 300 ft. in length and frame a picture of Chicago's loop as it was in 1925 when the old hotel was replaced by the new building. It took 40 artists two years to complete these murals under the direction of William Welsh, famed portrait painter.

There are 2200 guest rooms, some 200 of them air-conditioned, 60 stores and shops, 34 air-conditioned private dining rooms, among them the famous Empire Room, one of Chicago's leading dinner-supper clubs.

The Palmer House has constantly served more meals to the public each day than can be claimed by any other hotel in the world. The daily average for the last fiscal year was over 9000 meals served in the six public dining rooms and 34 private dining and meeting rooms, including the Grand Ballroom and the Red Lacquer Room. The hotel operates nine kitchens, not including its pastry kitchen, its own bake-shop and its own ice cream plant and butcher shop, where the meats and fowls are prepared as the various kitchens requisition them.

Interesting historical events in connection with the Palmer House would include the famous banquet tendered General Grant on his return from his trip around the world; and Kipling's stay in the hotel while in Chicago en route to India. President Cleveland received notice of nomination in the lobby of the old Palmer House and addressed the crowds from the famous staircase. The silver dollars in the floor of the barber shop were of world-wide fame and attracted thousands who came to Chicago to see the World's Fair of 1893, which, incidentally, was planned in meetings held in the old hotel.

ABOUT CHICAGO

Brief History.—The records go back to Louis Joliet's first exploration in 1673. He was commissioned to investigate the upper Mississippi and with Father Marquette, who a year later established a mission for the Indians there, visited this neighborhood. The French dominated the region until 1759, when the British, with the aid of certain colonists, conquered the country and in turn were forced to relinquish control by George Rogers Clark a few decades later. In 1795 the United States acquired title to a plot of ground six miles square at the mouth of the Chicago River, and in 1803 Fort Dearborn was built. This was named after Secretary of War General Henry Dearborn. The first boom occurred in 1833 after the Black Hawk War. On August 10 of that year there were 550 residents and four years later, 4000. In 1870 there were very close to 300,000, and today the latest census records show over 3 million.

Museums.—The eight principal museums are grouped in a convenient manner. The Field Museum of Natural History is one of the outstanding scientific museums in the world. It is very conveniently located from The Palmer House, with frequent bus transportation. The Museum of Science and Industry in Jackson Park covers much of man's technical progress with working models of machines and devices, including a very extensive miniature railway. The Adler Planetarium is near the Field Museum, and the Art Institute, with a very notable collection of art masterpieces, is the second largest museum in the country, and is very near The Palmer House on Michigan Ave. at the foot of Adams St. Perhaps not so well known, but outstanding, is the Oriental Institute at the University of Chicago containing one of the finest American collections of relics from ancient civilizations of the Near East. The Shedd Aquarium, one of the world's finest, the Academy of Sciences, and the Historical Society complete the group.

Parks and Zoos.—Chicago's diversified system of parks, zoos, and woods is extremely extensive. Garfield Park has one of the finest botanical gardens in the world, more than 5000 specimens. The fern house is especially noted. The formal rose gardens of Humboldt Park have about 7000 plants of 30 varieties, and are usually in full bloom in June. The 20-acre bird sanctuary and the Japanese Gardens and pavilions of Jackson Park are famous. Chicago's two outstanding zoos are the Brookfield Zoo, which features natural habitat areas for most animals, and the Lincoln Park Zoological Gardens.

Industrial Establishments.—One of the world's greatest industrial centers, Chicago has a great many places of interest for men, women, and children and while many industrial tours and trips have had to be curtailed or cancelled because of defense arrangements, full details of those available will be furnished to A.S.T.M. members through the local Committee on Arrangements at The Palmer House. The food and meat-packing industry is of particular interest, there are various laboratories and mail order establishments, and Chicago's department stores are, of course, famous.

For those who wish to carry away an over-all impression of the great city, there are four public observatories: Board of Trade Building, Chicago Towers Club, Tribune Tower, and Wrigley Building.

*Material Testing Problems Arising from the Advance in Airplane Performance**

By W. B. Klemperer[1]

IN THE SHORT SPAN of one generation, aviation has grown from the infancy of pioneering experimentation to where it has become the fastest means of transportation for goods of commerce and, unfortunately, of weapons of destruction. Performance dreams which only a few years ago appeared as ultimate limits are commonplace specifications today and probably obsolete tomorrow. Stratosphere altitudes of 35,000 ft., ranges of the order of 8000 miles radius of action, carrying capacities of 20 tons, or cruising speeds of the order of 400 mph. are within the realm of modern aircraft today.

Material testing is in two ways concerned with the advance of flight performance. On the credit side, the more exact the accuracy of our knowledge of uniform material properties, the less margin of uncertainty has to be built into the structure; every pound of weight or drag so saved benefits performance directly. On the debit side, drastic increases in performance entail new hazards such as extreme cold, high ram pressures and suctions, low atmospheric pressures, vibrations and accelerations. Now that in war man-made hazards of combat are added to the hazards imposed by nature, we must seek materials which not only stand up without failure or deterioration but actually heal when hit or injured. These hazards have to be studied and tests made under controlled conditions in the laboratory.

Airplanes must work equally well in the arctic and in the tropics, which regions are now less than a day's flight apart. In the stratosphere the temperature is -67 F. At that temperature most lubricants get stiff, windows have a tendency to frost over which defeats their very purpose, rubber is not very rubbery, neither is the binder in shatterproof glass. The major aircraft companies in an effort to avoid cold trouble at high altitudes are now installing cold rooms in which a good size refrigeration plant maintains a temperature of -70 F. The cold laboratory now under construction at the Douglas Aircraft Co., Inc., will have a capacity of 60,000 Btu. per hr. The room is 14 by 11 by 8 ft. in size, and heavily insulated. Access is afforded by a double door entrance lock. A small blower is available to simulate a cold air blast. In this room mechanical, electrical, and hydraulic accessories such as control hinge and lever mechanisms, pumps, valves, and materials for windshields, windows, diaphragms, seals, and caulking can be tested for functioning, tightness, or brittleness in extreme cold.

Some rather unexpected things happen to materials, structures and, not to forget, to the human organism at high altitude because of the low atmospheric pressure prevailing up there. Air bag pillows and sponge rubber having closed cells grow to almost twice their size when brought to 20,000 ft. Double-glazed hermetically sealed window sash will bulge; warm gasoline evaporates and causes vapor lock; pumps are harder to prime. At extreme altitudes ignition sparks will jump across insulation gaps.

To simulate the low pressures of high altitudes in the laboratory some of the aircraft companies have constructed inhabitable decompression chambers. The Douglas Aircraft Co., Inc., has an altitude laboratory (Fig. 1) comprising two chambers, one accommodating seven people and the other four. A 100 cu. ft. per min. vacuum pump serves to evacuate the tanks. The altitude can be controlled from a master control stand or from within the chamber; in fact, a pilot can "fly" the chamber by means of a dummy control stick very much as he would climb, dive, or level off an airplane (Fig. 2). This arrangement enables the

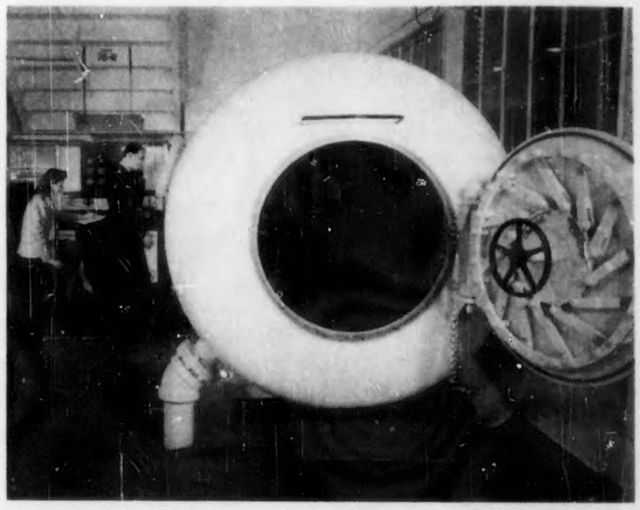

Fig. 1.—Altitude Laboratory of the Douglas Aircraft Co., Inc.

Fig. 2.—Interior of Altitude Laboratory.

* Presented at the Los Angeles Meeting Sponsored by the Southern California District Committee, February 20, 1941.

[1] Douglas Aircraft Co., Inc., Santa Monica, Calif.

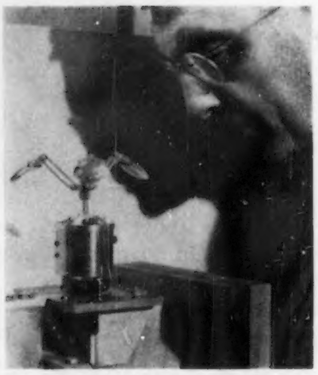

Fig. 3.—Tensor Gage.

Fig. 4.—Application of Tensor Gage.

test flight crews to practice high altitude ascents and descents and get used to special altitude equipment prior to the actual flight.

To make the airplane livable at high altitudes the cabin can be supercharged. It is then maintained at a pressure higher than that prevailing at the flight level, controlled by sensitive pressure regulators and ventilated to appropriate air conditioning standards. The altitude laboratory serves to test materials, structures, and apparatus required in pressure cabins, for functioning, fatigue, and maintenance under simulated service conditions before the lives or welfare of crews and passengers are entrusted to machines under novel conditions. In cabin supercharging tests one of the altitude chambers represents the cabin. The other is independently regulated at "flight" altitude pressures. Ventilation air is controlled to flow from the cabin into the altitude tank.

The introduction of pressure cabins gave rise to a whole group of problems new to aircraft designers. To seal the seams of a riveted sheet metal fuselage and transform it into a tight pressure vessel required a vast search for suitable caulking material that would stand heat and extreme cold and would never become leaky or brittle; it must be easily applicable and fluid enough to flow into crevices and gaps at lapped seam joints, and yet viscous enough not to blow out under pressure, clean and free from objectional odors, noncorrosive to metals, and permanently adhesive to them. Neoprene cements and neoprene impregnated fabric tape have been developed for this purpose.

Structurally, many interesting new problems arose. Strictly speaking they are problems of fabricated structures rather than of primary materials. However, since different material properties become of importance for various structures the material testing engineer is quite legitimately interested in these developments, especially in so far as they have led to new contributions to the art of strain gaging.

Streamlining has developed into the art of crowding incredible amounts of powerful machinery and a maze of plumbing, mechanical, and electrical systems into a minimum of wing, nacelle, or fuselage space. To save space, articulated trusses are preferably replaced by shell and frame structures. The calculation of the stress flow in such members as they grow increasingly intricate requires experimental verification. Cabin supercharging for high altitude flight made it necessary to design the fuselage for internal pressure which gives rise to peculiar stress problems.

The pressure cabin is a thin-walled pressure vessel with many local reinforcements, highly redundant. Under pressure it tends to assume circular cross-section; individual panels tend to bulge between reinforced edges. The skin is stressed in tension in two directions by pressure and in shear by forces transmitted from the load stations to the wings, empennage, and landing gear. Stress concentrations are inevitable around windows, cockpit enclosures, wheel wells, wing spar connections, etc.

The complete description of the state of strain in any place of thin stress-carrying skin requires at least three measurements in different directions from which the principal strains and the orientation of their axes or the whole strain circle can be readily derived by trigonometry or graphical construction. Conventionally these measurements are obtained by applying three or more strain gages in rosette fashion. The recently developed tensor gage[2] does the work of the whole rosette directly (Fig. 3). This instrument is held against the structure by a single suction cup (Fig. 4). It engages the sheet in the three corners of an equilateral 1-in. triangle by means of sapphire points mounted on a small mechanical tripod of high precision. Its legs are accurately restrained to move only in the direction of the radii of a 120-deg. star (Fig. 5). Each leg rocks without perceptible friction in a grooveless saddle and carries an optical lever which, when viewed through an eyepiece, magnifies the displacement of the contact point over 650 times. The instrument is $1^3/_4$ in. in diameter and $2^1/_2$ in. high and weighs 4 oz.; it gives the three readings in 120-deg. directions at once (Fig. 6). Although designed for airplane research it can also be useful in other branches of engineering where three-component stress and shear distribution problems arise as in pressure vessels, dams, ships, bridges, domes, and gussets.

Where strains have to be studied on extremely short gage length, for instance, within the wave pitch of sheet wrinkles, interesting details have been learned by means of a small strain gage of 0.2 in. gage length (Fig. 7), called the "maze gage" because its flexure plate mechanism is produced by cutting a maze of slots in a single block of metal, to avoid all hinge friction, a method pioneered by L. Meisse of the Ohio Brass Co. There is only one moving part, namely, a rocking prism through which a scale is

[2] Described in a paper by the author entitled "The Tensor Gage," *Journal of the Aeronautical Sciences*, Vol. 7, No. 9, July, 1940, p. 403.

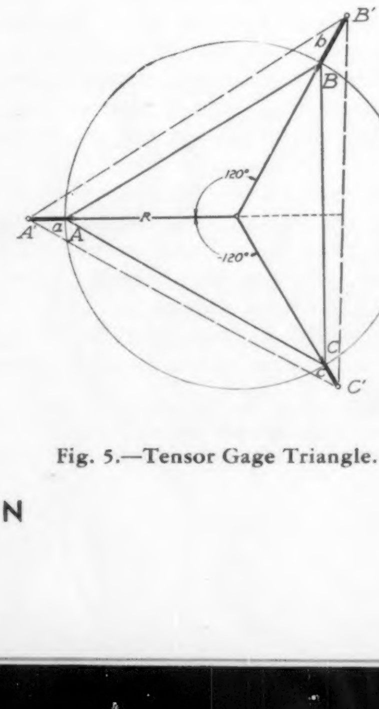

Fig. 5.—Tensor Gage Triangle.

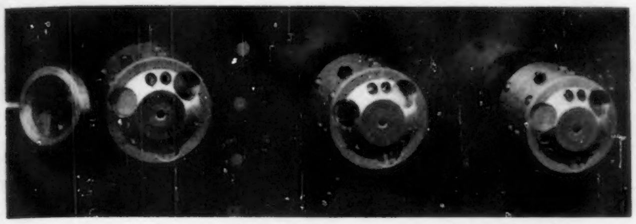

Fig. 6.—Three Tensor Gages on Fuselage Panel.

viewed in double reflection by means of a telescope. An index is viewed through a similar fixed prism mounted on the gage. Thus the exact position of the telescope is of no import, only the distance of the scale from the prism counts as the length of the optical leverage. The optical principle involved is half way between the well-known Martens mirror and the modern Tuckerman auto-collimator gage. The maze gage readily measures strains of 200 psi. and because of the round points it functions accurately in the presence of shear.

Optical magnification lends itself well to laboratory work but not so well to flight work. As stress measurements required in trial flights to confirm analysis assumptions grow more involved and many strain gages have to be placed in inaccessible places of the aircraft structure, it becomes necessary to transmit the reading electrically to a remote central recording station. Recorders must respond instantaneously to catch the peaks of transient surges in gusts, flight maneuvers, and landing shocks (without wasting miles of records when for long periods nothing important happens). Electric inductance strain gages perfected by Cambridge, General Electric, Westinghouse, Sperry, Douglas (Fig. 8), and others have been successfully used in flight trials, for instance, to record stresses in wing spar caps in engine mounts and on control members. The inductance gage (Fig. 9) contains a pair of minute choke coils which are hooked up in an alternating current bridge circuit fed by a 1000- to 2000-cycle carrier current.

As the number of strain gages on any one test job is now growing into the hundreds, it has become imperative to reduce the cost of the strain gages themselves, of their fastening means, and of the recording apparatus. This led to the development of the electrical resistor as a strain gage element devoid of all mechanism. A. V. de Forest has been the exponent of this development. It started with the familiar carbon pile microphone which changes its electrical resistance with pressure. The next successful step was a strip of a semiconductor made up of carbon compounds bodied with bakelite. These unpretentious gage strips were cemented to the test structures and have found wide use in propeller vibration stress investigations which were extremely instructive and fruitful.

More recently de Forest has revived a metallic version of this same resistance type of gage, by winding extremely fine wire like a zigzag rheostat along a gage length of 1 in. or so and solidifying this delicate cobweb on rice paper with cellulose dope to the point where the wire not only becomes longer and thinner under tension but also reversibly takes compression without buckling. As the wire in following the strain of the structural material to which it is cemented changes both its length and its cross-section area, it simultaneously varies its electrical resistance in double proportion. This type of gage is marketed by the Baldwin Southwark Co., both with and without bimetal wire temperature compensation. It has found numerous applications in the hands of the aircraft manufacturers (Fig. 10). It has been found feasible to manufacture these gages in such manner that their calibration stays uniform and constant enough to require no individual calibration check. Obviously the same type of gage is universally applicable to numerous problems in other branches of engineering—for instance, new railroad coaches, ships, bridges, tall buildings.

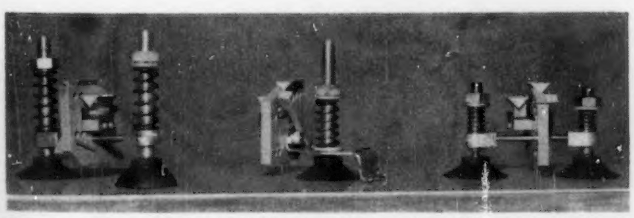

Fig. 7.—Maze Gages of Various Gage Lengths with Various Attachments.

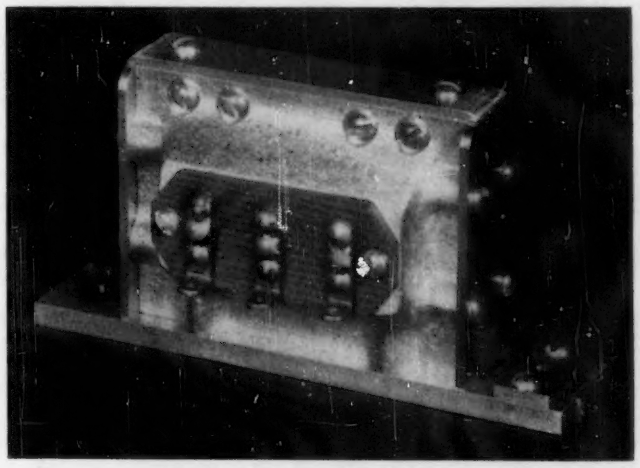

Fig. 8.—Inductance Strain Gage.

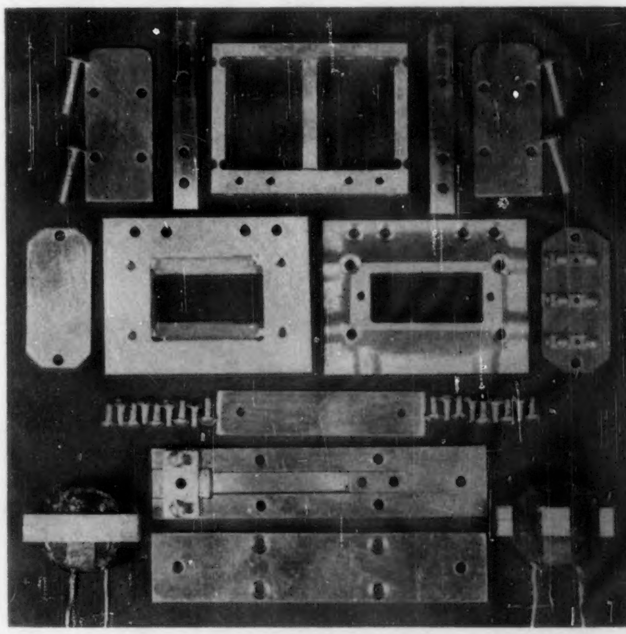

Fig. 9.—Inductance Strain Gage Disassembled.

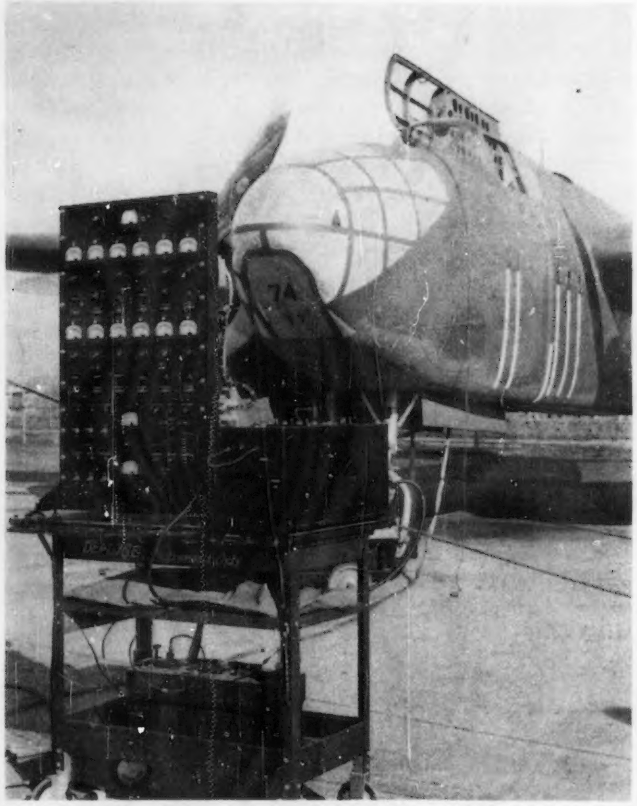

Fig. 10.—Multiple Channel Oscillographic Equipment and Resistance Strain Gages Applied to Fuselage Skin for Investigation of Propeller Slip Stream Pressure Waves.

Fig. 11.—Craze Bending Test.

Where a complete survey of the stress flow and its distribution is required, recourse is had to a photoelastic study of a structural model of transparent material in polarized light. The transparent plastics have themselves become important as structural materials, partly because of their electric insulating properties, partly because of their transparency. The methyl methacrylate, Plexiglas, and Lucite with their remarkable clarity and permanency, strength, formability, and toughness have proved especially successful as windows and enclosures for gun and bombardier's stations. The problem of fastening the transparent plastic airtight to the metal structure involved several serious problems; one is the different thermal expansion coefficient —$^2/_3$ per cent compared with $^1/_8$ per cent per 100 F. for aluminum—and the other is stress crazing.

Plexiglas, Lucite, Vinylite, and some other similar materials when subjected to tensile stresses for extended periods eventually develop minute fissures which interfere with strength and with clear vision under light at certain incidences. This phenomenon is usually referred to as "crazing." In bending (Fig. 11) and in shear or under

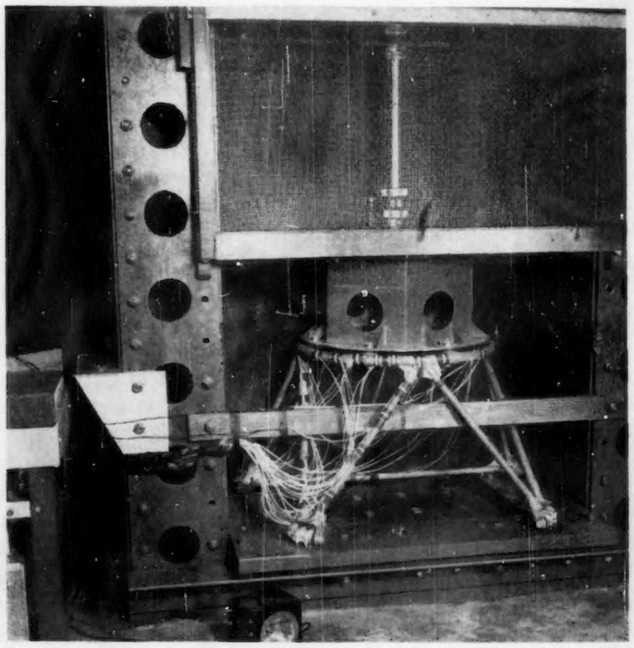

Fig. 12.—Engine Mount in Forced Vibration Test.

other compound stress conditions the fissures appear at right angles to the principal tension direction. At room temperature it takes about 5 days at 4000 psi., 10 days at 3000, and a month at 2000 psi. tension for the fissures to show up. Lesser stresses apparently do not cause crazing after any duration. In extreme cold the process is slower but more insidious. It can be enormously accelerated by chemical action. Swabbing the stressed area with certain harmless chemicals develops the stress craze pattern immediately as though the previously tough material had suddenly become brittle, although in the relaxed state the material is not attacked by the same chemicals. This observation led to the application of stress pattern etching as a means for the study of stress distribution in gussets, lugs, and the like, similar in a way to the technique of brittle

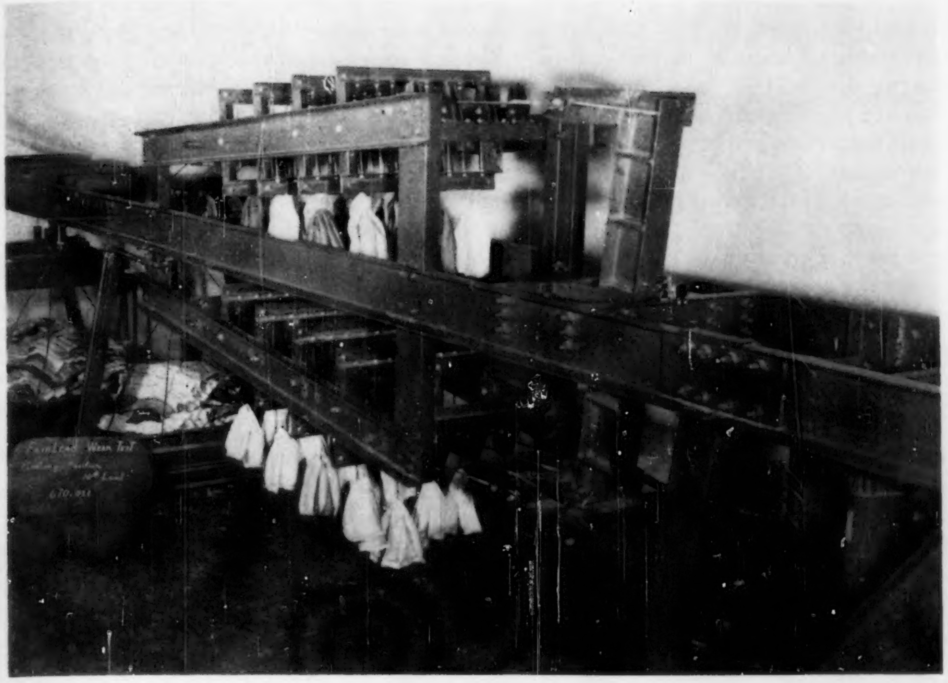

Fig. 13.—Cable Fairlead Wear Test.

lacquers described by A. V. de Forest in the March, 1940, issue of the *Journal of the Aeronautical Sciences*.

Much experimental work has been done to explore the behavior of thin-walled structures, and especially of regularly reinforced panels under compression, shear, and diaphragm pressure. Tests on sheet panels reinforced on one side by stringers have led to improvements of the conventional parallel motion and rack-and-pinion type of extensometers like the Whittemore or Tripolitis instruments as it was found expedient to design such gages with continuously adjustable gage length to match rivet pitch and to miss skin wrinkles.

However, most of these investigations simply reveal the strength or deformation of the particular construction rather than any properties inherent to the material itself. Elaborate micro-stress-strain studies such as those reported by Templin and Sturm in the *Journal of the Aeronautical Sciences*, March, 1940, give pretty good insight into the behavior of the important metals under cyclic loads and coldworking. Apparent departures of structures can usually be ascribed to stress concentrations, misalignments, and structural instability.

Material testing in the service of the periodical checking of the skill of welders and the reliability of arc-, flash-, and

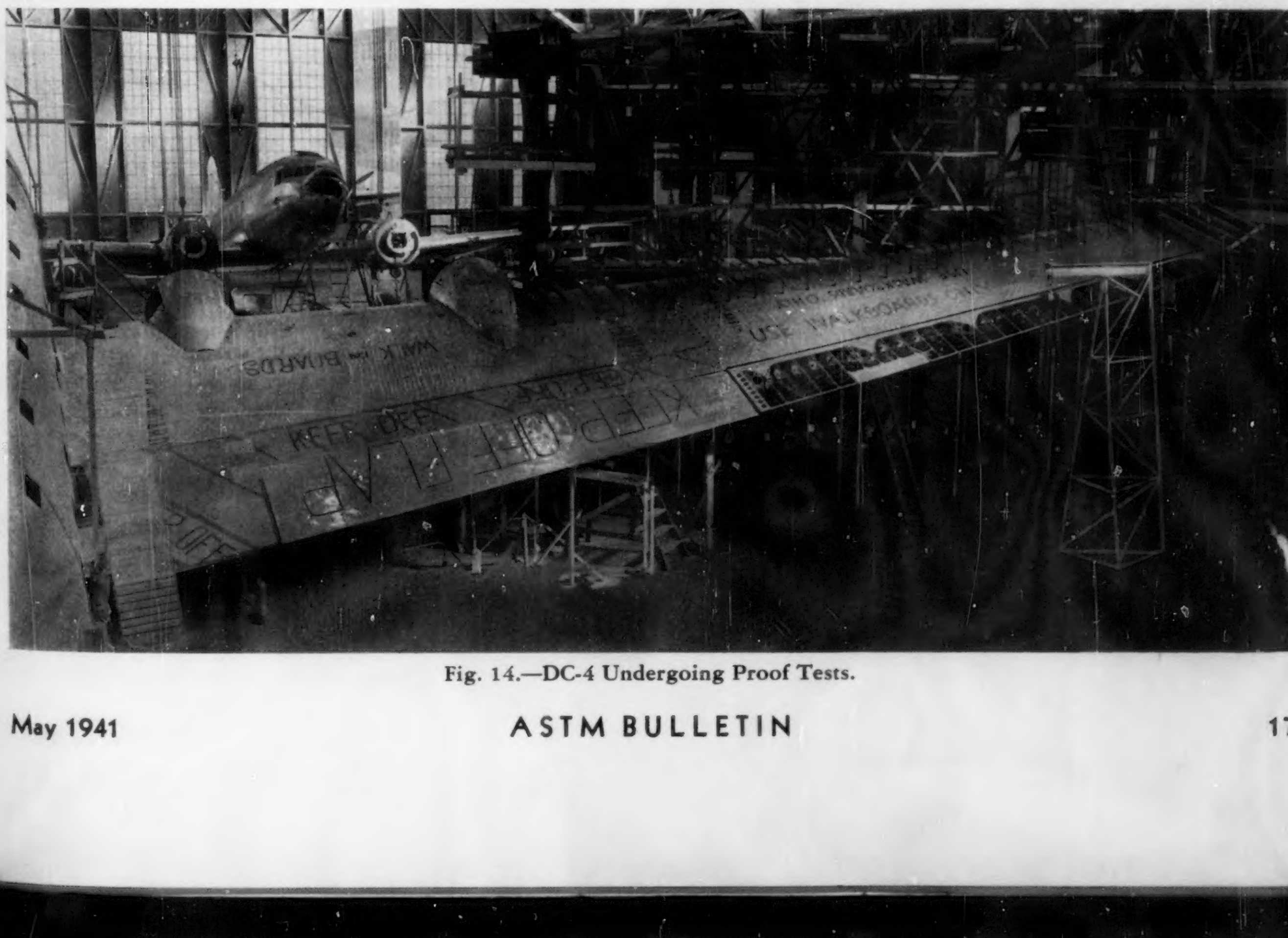

Fig. 14.—DC-4 Undergoing Proof Tests.

roll-welded joints has greatly increased since these methods are gradually replacing torch welding because of greater speed of manufacture, neatness, and weight saving. All flash-welded subassemblies are proof tested and complicated welded assemblies such as motormounts, etc., are magnaflux inspected. X-ray inspection of welds and castings is also gaining in importance as an adjunct to the material testing laboratory routine of aircraft companies.

Corrosion and its combat has been given a great deal of attention in the past. However, under the pressure of war conditions resistivity to corrosion and long life are relegated somewhat to the background in favor of extreme performance.

Fatigue problems, on the other hand, have gained in importance as speeds and power have increased. Vibrating jigs that can be run over a great range of frequencies and amplitudes, translational and rotational, are running day and night. Complete engine mounts (Fig. 12) were vibrated in forced vibration and the energy flow was studied by a whole forest of thermocouples and strain gages. Fatigue tests of fabricated structural elements such as spars, joints, etc., are being conducted, preferably by resonance methods. The Goodyear Tire and Rubber Co. and the National Bureau of Standards have been pioneering this type of work, exciting the structure by powerful magnetic pulsators. In interpreting results of such fatigue tests, extended over millions of cycles, not only the fatigue strength of the basic material but also the influence of cold forming and the stress concentrations about rivet holes or other joints must be taken into consideration.

As airplanes grow bigger or faster, the control cable problems become more serious. Rig loads vary with temperature due to different expansion coefficients of cables and structure. Cables are tested for vibration, fatigue, and means are devised to keep vibrations in safe bounds (Fig. 13).

As flight speeds increase, landing speeds increase too, in spite of the advance made in flaps or high lift devices. This influences the testing of materials for airplane brakes for the heat generated in stopping an airplane before it runs out of field increases as the cube of its velocity.

As far as size, load-carrying capacity, and flight endurance are concerned, heavier-than-air craft are still far from reaching the performances of the rigid airships of the lighter-than-air class, with their 400,000 lb. of gross lift and 2-weeks cruising range. These huge, immensely redundant structures were a veritable paradise for the strain-gage fiend. Some of the research work done in connection with the big dirigibles may still be of interest and eventually applicable to large airplanes. For instance, means were developed for measuring the strain in any structural member at any time, by making two microscopically fine gage marks exactly 11 in. apart along the cornices of many hundreds of girders before they were assembled into the ship. These could be inspected by the Stressoscope, a comparator type of double objective microscope in which the two marks appeared against a strain scale in the focal plane of a single eyepiece. This inspection would tell the strain at a glance at any time after assembly, during inflation, under proof loads, in flight, after return from flight, and especially during repair, to avoid building undesirable assembly stresses into the surrounding structure when replacing damaged members by new ones.

Another device developed for airships and potentially useful for other aircraft is the stress cycle counter. This is a device which counts the number of load peaks exceeding certain strain thresholds of tension or compression in the member to which it remains attached during service. Such measurements give valuable information regarding the fatigue strength that should be built into new aircraft and the conditions to which they should be proof tested before committed to service.

With the gradual increase of the size of airplanes, the requirements for proof testing materials and structures after final assembly have become greatly enhanced and proof tests (Fig. 14) have grown increasingly more involved and expensive. The primitive methods of loading by sandbags or pig lead are giving way to intricate systems of interconnected hydraulic jacks disposed in great numbers and intricate arrangements in space so as to permit all loads to be applied and increased simultaneously, gradually, and in the desired proportion.

New refinements of design, new methods of fabrication to make better use of the structural materials, and the development of new materials and possibly new fuels will undoubtedly continue to help boost flight performances in gradual steps or occasionally by leaps and bounds. The struggle for air supremacy, which in peace time means leadership in commerce and in war time determines national existence, is fought not only in the air but to a large measure in the design room and in the laboratory.

"A.S.T.M. Designation D 90-?"

Awarded honorable mention, professional class, in the Third A.S.T.M. Photographic Exhibit; Submitted by H. R. Luck, Shell Development Co.

A Proposed Method of Designating Color

By Francis Scofield,[1] Deane B. Judd,[2] and Richard S. Hunter[2]

SYNOPSIS

A proposed tristimulus method of designating color is described together with some of its applications. The proposed method is used for designating numerically the colors of opaque objects and transparent materials. Combined in the new system are a number of desirable properties: (1) relation by transformation equations to the standard I.C.I. system, (2) choice of a chromaticity diagram yielding approximately uniform chromaticity scales and having an origin at the neutral point so that it is easy to visualize the appearance of a specimen from the coordinates of its color, and (3) the opportunity to compute coordinates of colors rapidly from settings on the respective samples taken by means of any one of several of the recently developed photoelectric tristimulus colorimeters.

At the recent A.S.T.M.-I.S.C.C. joint Symposium on Color—Its Specification and Use in Evaluating the Appearance of Materials,[3] attention was called to the commercial importance of the colors of many of the different materials with which the A.S.T.M. deals. The science of colorimetry has advanced rapidly in recent years so that greatly improved methods of measuring and numerically designating the colors of materials are now coming into use. The present paper deals with one of these new methods which it is felt may prove particularly well suited to some of the problems of color testing and specification with which the A.S.T.M. deals. In the work of the Society's Committee D-1 on Paint, Varnish, Lacquer, and Related Products, a system of the type briefly described below could be used to indicate the depth of color permissible in oils, varnishes, and other liquids, to evaluate the tinting strength of white and colored pigments, to measure the amount of fading of tinted paints, and to determine the degree of yellowing of white paints and enamels.

The method of designating color which is described in the present paper was brought to the attention of the Society in a paper given as part of the Symposium on Paint Testing (*1*)[4] at its 1939 annual meeting. Although only described orally at this meeting, there developed from this description a considerable interest in the method. Because of this interest, the authors were asked by the chairman of Subcommittee XVIII on Physical Properties of Materials of Committee D-1 to prepare a short account of the method which would include some of its possible uses, chiefly in the paint field.

Before describing the new tristimulus method for designating colors, it seems desirable to give a brief explanation of what a tristimulus method is. Such an explanation was prepared a few months ago (*2*), and in the following three paragraphs this explanation is repeated.

"Color may be specified either by identifying a particular combination of lights requisite to produce a match, or by identifying a material standard which, in conjunction with a known illuminant, will produce a match. Since any uniform portion of the visual field near its center may be seen by a normal observer to vary in three independent ways, there must always be three independent variables in a color specification.

"The most convenient way to specify color by identifying a particular combination of lights is to give the amounts of three primaries required to produce a color match by additive combination. This is called the tristimulus specification of color, and because of its convenience it is used as a common denominator by means of which all other systems of color specification may be interrelated. The colorimetric coordinate system recommended in 1931 by the International Commission on Illumination (the I.C.I. system) (*3*) is now the most widely used tristimulus system. Linear, homogeneous transformations of the I.C.I. system have been proposed for various purposes, some for greater simplicity in computation, some for providing uniform chromaticity scales, and others for quantifying theories of color vision.

"Another form of identifying a combination of lights to specify a color is to give the brightness of one light of fixed quality (such as average daylight) and the brightness of a light of variable quality separately identified (as by wave length in the spectrum). This form of identification leads naturally to a separation of the three variables into a brightness and two chromaticity variables. The two chromaticity variables, a length and an angle, yield a polar coordinate system. The angle is identified variously as dominant wave length, hue wave length, hue angle and hue number; it varies with the wave length of a spectrum light and correlates well with the hue of the perceived color (provided the fixed light appears achromatic). The length is known variously as colorimetric purity or spectral brightness purity, spectral excitation purity, basic brightness purity, and basic excitation purity; with proper choice of fixed light it correlates fairly well with the saturation of the perceived color."

The method described herein is a tristimulus method, but the coordinates given can be readily converted to numbers which respectively designate the hue, lightness, and saturation of the color perceived as belonging to any given object.

Definition of the Coordinate System

It is proposed to specify by three numbers the color of any object illuminated by I.C.I. illuminant C (a standard illuminant similar in spectral character to average daylight) (*3*). One of these three numbers will, as suggested, serve to indicate lightness and is either the luminous ap-

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NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

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[2] Physicist, and Assistant Physicist, respectively, National Bureau of Standards, Washington, D. C.

[3] Symposium available as separate publication, June, 1941.

[4] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

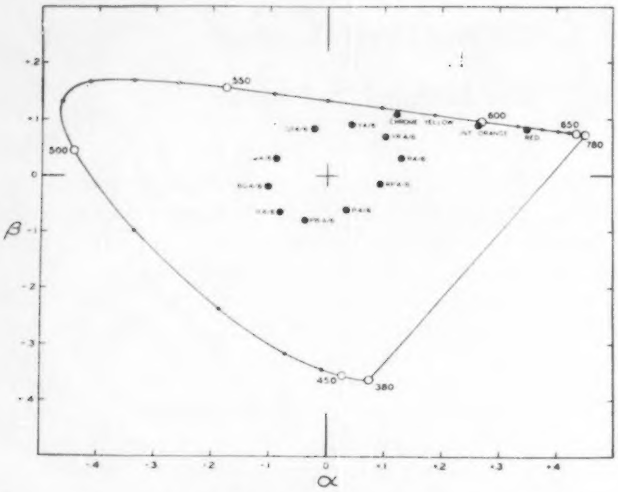

Fig. 1.—The (α, β)-Diagram Showing the Locus of Spectrum Colors, the Points Representing Ten Munsell Colors, the Points Representing Three Federal-Specification Colors, and the Origin, or Neutral Point.

parent reflectance, A_{θ_I,θ_V}, of a specimen viewed by reflected light, or the luminous transmission, T, of a specimen viewed by transmitted light. The other two numbers, α and β, will serve to specify the chromaticity of the color and are related to values in the standard I.C.I. system (*3*) by the following equations of transformation:

$$\left.\begin{aligned} \alpha &= \frac{2.4266x - 1.3631y - 0.3214}{1.0000x + 2.2633y + 1.1054} \\ \beta &= \frac{0.5710x + 1.2447y - 0.5708}{1.0000x + 2.2633y + 1.1054} \end{aligned}\right\} \quad \ldots\ldots\ldots(1)$$

where x and y and α and β are trilinear coordinates of the sample (x and y on the I.C.I. system, α and β on the proposed system). The reverse transformation is given by the equations:

$$\left.\begin{aligned} x &= \frac{0.5583\alpha + 0.1631\beta + 0.2466}{0.0100\alpha - 1.4347\beta + 0.7951} \\ y &= \frac{-0.2515\alpha + 0.6285\beta + 0.2515}{0.0100\alpha - 1.4347\beta + 0.7951} \end{aligned}\right\} \quad \ldots\ldots\ldots(2)$$

When α is plotted against β in rectangular coordinates, a Maxwell triangle or mixture diagram results on which equal chromaticity-differences between surface colors are represented by approximately equal distances. The uniformity of the chromaticity spacing afforded by this (α, β)-diagram is thought to be superior for colors subtending large visual angles to that of the Judd U.C.S. triangle (*4*). In deriving the new diagram, use has been made of preliminary conclusions from studies of the applicability of the U.C.S. triangle to the specification of uniform color tolerances for surface colors of large area (*5, 6, 7*). Although planned chiefly for surface colors subtending large visual angles, the (α, β)-diagram does not differ so markedly from the earlier U.C.S. triangle that it cannot be used for the colors of clear liquids and other specimens usually observed in smaller areas.

Figure 1 shows the spectrum locus of the (α, β)-diagram. Compared to the U.C.S. triangle, the distance from the long-wave (red) extreme of the spectrum locus to the illuminant point has been shortened, that from the middle (green) part of the spectrum locus has been lengthened, and the length of the line connecting the extremes of the spectrum locus has been decreased. This latter change accords with a conclusion drawn from studies with Lovibond glasses (*8*). In addition to the spectrum locus, points representing the ten Munsell[5] hues at value 4 and chroma 6 are plotted in Fig. 1 together with points representing MgO illuminated by I.C.I. illuminant C (plotted at the origin), medium chrome yellow (Federal Specification TT-P-53, 2/12/37), international orange (Federal Specification TT-P-59, 6/17/37) and water-resistant red enamel (Federal Specification TT-E-531*a*, 6/4/35). The values of α and β, which are given in Table I, were all computed from x and y according to Eq. 1.

Advantages of the Coordinate System

The above tristimulus system for designating colors possesses a number of properties which make it potentially useful to the Society. Although differing from those in the I.C.I. system, values in the new coordinate system are numerically related by Eq. 1 to those in the internationally recognized system. Since it is thus possible to derive values of α and β from x and y, which in turn can be computed from the spectral curves of the samples represented, values of α and β can also be computed from the spectral curves of samples. It will be remembered that A.S.T.M. Standard Method of Test for Spectral Apparent Reflectivity of Paints (D 307–39)[6]

[5] Trilinear coordinates read from smoothed curves by Nickerson (*9*), see Table II.

[6] 1939 Book of A.S.T.M. Standards, Part II, p. 815.

TABLE I.—THE TRILINEAR COORDINATES, IN BOTH x AND y AND α AND β, WHICH ARE REPRESENTED BY POINTS IN FIG. 1 TO SHOW THEIR RELATIVE POSITIONS IN THE (α, β)-DIAGRAM.

Color	x	y	α	β
Toluidine Red, Federal Specification TT-E-531a	0.668	0.318	+0.3474	+0.0828
International Orange Federal Specification TT-P-59	0.610	0.362	+0.2625	+0.0900
Medium Chrome Yellow Federal Specification TT-P-53	0.519	0.453	+0.1210	+0.1092
Munsell colors				
R 4/6	0.430	0.317	+0.1287	+0.0308
YR 4/6	0.451	0.387	+0.1009	+0.0692
Y 4/6	0.429	0.448	+0.0427	+0.0910
GY 4/6	0.367	0.459	−0.0225	+0.0837
G 4/6	0.261	0.393	−0.0992	+0.0299
BG 4/6	0.226	0.323	−0.1034	−0.0193
B 4/6	0.214	0.261	−0.0827	−0.0648
PB 4/6	0.233	0.233	−0.0394	−0.0792
P 4/6	0.289	0.233	+0.0324	−0.0603
RP 4/6	0.362	0.269	+0.0917	−0.0141

TABLE II.—COLORS OF TWELVE GLASS COLOR STANDARDS OF THE A.S.T.M. UNION COLORIMETER.

Standard Color	Luminous Transmission, T	I.C.I. Trilinear Coordinates		(α, β) Trilinear Coordinates	
		x	y	α	β
No. 1	0.751	0.3488	0.3815	+0.0022	+0.0446
No. 1½	0.654	0.3995	0.4460	+0.0159	+0.0845
No. 2	0.443	0.4724	0.4765	+0.0660	+0.1099
No. 2½	0.365	0.4985	0.4570	+0.1006	+0.1071
No. 3	0.287	0.5252	0.4402	+0.1344	+0.1054
No. 3½	0.211	0.5561	0.4234	+0.1721	+0.1046
No. 4	0.096	0.5908	0.3995	+0.2183	+0.1014
No. 4½	0.065	0.6199	0.3758	+0.2603	+0.0974
No. 5	0.036	0.6528	0.3467	+0.3107	+0.0918
No. 6	0.017	0.6764	0.3234	+0.3497	+0.0867
No. 7	0.0066	0.6841	0.3155	+0.3629	+0.0849
No. 8	0.0020	0.7140	0.2860	+0.4141	+0.0782

covers the method of obtaining the spectral curves of paint samples.

There are several valuable properties of the new system which are not possessed by the I.C.I. standard system. In the first place, the (α, β)-diagram yields fairly uniform chromaticity-scales which are especially well suited for representing the colors of surfaces and other stimuli covering large areas in the field of view. Values of α and β can be used to designate the chromaticities of transparent liquids and other nonopaque objects as well as of surfaces.

Secondly, the chromaticity diagram of the new system is plotted in rectangular coordinates with the origin at the neutral point. By transforming values of α and β for opaque surfaces to polar coordinates, numbers are obtained which can be combined with the square roots of the apparent reflectances of the respective surfaces to give numerical records of the colors of the surfaces in variables which the layman will recognize. The polar angle gives a number correlating well with hue; the square root of apparent reflectance, a number correlating closely with lightness (or value); and the polar radius, a number correlating fairly well with saturation (or chroma). Thus numbers may be assigned to a surface which will correspond to the attributes, hue, lightness, and saturation, which the layman thinks of when he describes the color perceived as belonging to a surface as "deep red" or "pale blue-green."

The third advantage has to do with the speed with which values of α and β may be determined on the recently developed, relatively inexpensive photoelectric tristimulus colorimeters. From the viewpoint of the Society, it is important that the techniques of measuring the samples and obtaining the desired numerical designations of color be not too complicated. That these techniques are not too complicated will be shown below. Only three or four readings need be obtained from each sample and these are quickly converted to suitable values of α, β, and A_{θ_I,θ_V} or T by a few steps of computation.

Measurement of the Coordinates α and β

As was noted above, a sample can be measured with a spectrophotometer, then values of x, y, and A_{θ_I,θ_V} or T can be computed from the spectral curve, and finally values of α and β can be derived from x and y by using Eq. 1. However, this procedure is long and tedious and will, in practice, probably be followed only when it is necessary to calibrate a standard or to settle an argument requiring greater accuracy than that obtainable from measurements with photoelectric tristimulus instruments.

Instruments of this latter type are distinguished by the fact that each employs a source, filters, and a photocell which make the device as nearly equivalent to the I.C.I. standard observer as practicable. Of the several devices which have been described, only those designed by Hunter (*10*) and Perry (*11*) are suited for the measurement of samples under I.C.I. illuminant C. However, it is understood that two new instruments for the photoelectric tristimulus colorimetry of opaque and transparent objects will shortly appear on the instrument market. One will be a goniophotometer (American Instrument Co.) the geometric features of which were described by Wetlaufer and Scott (*12*); the other will be an apparent-reflectance and transmission meter (Photovolt Corp.).

Some photoelectric tristimulus colorimeters use three filters, others use four. With four filters, it is possible, as van den Akker has shown (*13*), to duplicate more closely than with three the spectral sensitivity of the I.C.I. observer. With three filters, however, one fewer setting is required for every sample; moreover the accuracy possible seems wholly adequate for many problems in which similar samples are compared for color. Three filters are used in the multipurpose reflectometer described by Hunter, and also, it is believed, in the instrument now being designed by the Photovolt Corp. Four filters are used in Perry's Blancometer, and four are planned, according to information supplied by the designers, for the goniophotometer.

The chief advantage of all these tristimulus colorimeters is the speed with which measurements of color can be made. Only a minute or less is required to obtain the readings of a sample for each of the three or four filters. Conversion of these settings to values of α, β, and A_{θ_I,θ_V} or T will usually take a little more time than was required for the settings, but when compared with the times required to obtain tristimulus values from other sources of data, it is very brief (6, p. 259). Actually the (α, β)-system was originally chosen so that it would be possible to convert quickly the readings from the multipurpose reflectometer to values of chromaticity in a uniform-chromaticity-scale mixture diagram. If readings relative to a standard with the amber, green, and blue filters of that instrument are designated by A, G, and B, respectively,

$$\left.\begin{aligned} \alpha &\doteq \frac{A-G}{A+2G+B} \\ \beta &\doteq \frac{0.4\,(G-B)}{A+2G+B} \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots(3)$$

Other photoelectric tristimulus colorimeters probably employ, or will employ, source-filter-photocell combinations which are spectrally almost identical to those used in the multipurpose reflectometer. Consequently it should be possible to convert settings from these other instruments to values of α and β as easily as settings from the multipurpose instrument.

One potentially serious source of error must always be thought of when tristimulus measurements are used to give values of α and β. The source-filter-photocell combinations used in the various photoelectric instruments fail to be spectrally equivalent to the I.C.I. standard observer. The errors which result from this spectral disparity vary with the amount of the disparity in the particular instrument and with the degree of spectral difference between the calibrated standard used and the sample compared with it for color (*14*). Thus the effect of this spectral disparity may be largely overcome, as was noted by Perry (*11*), by obtaining for the measurement of any sample a calibrated standard spectrally similar to it. By spectrally similar, it is meant that the spectral curves of the sample and standard must either approach identity or approach a condition in which they differ by a constant factor throughout the spectrum.

In spite of this limitation, photoelectric tristimulus colorimeters can be widely used to make color measure-

ments of the materials with which the A.S.T.M. deals. Perry has pointed out, for instance, that practically all white and near-white specimens can be considered spectrally similar to one another and can therefore all be measured against any calibrated white standard. Because of this simplification for the measurement of whites, Perry called the device designed by him the Blancometer (*11*).

Frequently the samples in a group to be intercompared for color are spectrally similar because of similar origin. When the specimens differ from each other only in the amounts of fading or bleaching which have occurred, in the concentrations of the pigment or dye present, or in the processing, aging, or heating treatments used to prepare the separate samples, they are very frequently similar in spectral character. When, on the other hand, the specimens of a group of similarly colored samples have been obtained by the use of different dye or pigment mixtures, they are likely to be spectrally dissimilar because of the probable different spectral properties of the different colorants used. The colors of the samples in a group of this latter type cannot be accurately intercompared with a photoelectric tristimulus colorimeter.

Applications of the Method for Designating Color

Experience with the proposed method for designating colors has demonstrated its usefulness for a number of purposes. There follow several examples which indicate how α and β, indicating chromaticity, and sometimes A_{θ_I,θ_V} or T, indicating lightness, are obtained and may be used to record various color characteristics of different types of specimens.

Finding Values of α and β from Values of x and y:

In published records, the chromaticities of specimens are usually designated by x and y because of the widespread acceptance of the I.C.I. observer and coordinate system as standard. When it is desired to find values of α and β in the new uniform-chromaticity-scale diagram from values of x and y, Eq. 1 is used. As already noted, to find, for use in Fig. 1, the values of α and β for the ten Munsell colors, the chrome yellow, the international orange, the toluidine red, and also the various spectrum colors, these equations were used with the values of x and y already known. Except for the spectrum colors, the values of x and y, and the values of α and β computed therefrom and used for Fig. 1 are given in Table I.

Recording the Colors of Oils:

It is thought that the new method may prove useful for describing the colors of oils. To indicate what might be accomplished in this respect, use of the new method for designating the colors of lubricating oils is demonstrated.

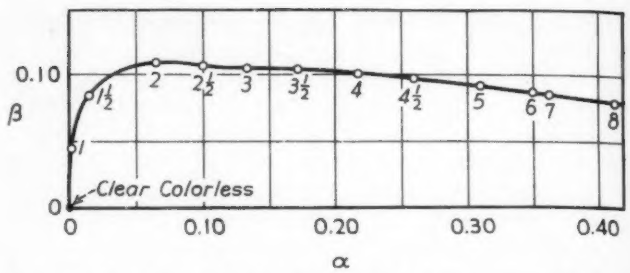

Fig. 2.—Part of (α, β)-Diagram Showing Chromaticity of the 12 Glass Combinations Used as Color Standards for the A.S.T.M. Union Colorimeter in Tentative Standard D 155 – 39 T.

Through the kindness of H. M. Hancock, Chairman of Subcommittee VI on Color of the Society's Committee D-2 on Petroleum Products and Lubricants, the spectrophotometric curves of the twelve glass combinations used as color standards for the A.S.T.M. Union Colorimeter[7] were placed at the disposal of the authors.[8] The luminous transmissions, T, and x, y, α, and β for each of the standards were computed from the corresponding spectral-transmission curves and entered in Table II. The point representing the chromaticity of each of these standards was then plotted in a section of the (α, β)-diagram, Fig. 2.

This diagram has been prepared to show the more accurate designation of colors possible with the tristimulus system. Not only would it be possible by the use of the new method to choose the best designation of the color of an oil on the Union Colorimeter scale, but it would be further possible to identify quantitatively any abnormal greenness or pinkness of the sample. Such a greenness or pinkness would be indicated by a location of the point representing the sample either above or below, respectively, the line of points of average oil colors plotted in Fig. 2. Incidentally, the spacing of the points in Fig. 2 shows that small adjustments of the colors of the standards would provide a scale of more uniform chromaticity intervals.

In addition to their use for the more accurate designation of colors of lubricating oils, values of α, β, and T could be used to represent the colors of shellacs, varnishes and other transparent materials.

Evaluation of Yellowing:

The values of α and β of panels of two white paints before and after exposure are used here to illustrate the

[7] Tentative Method of Test for Color of Lubricating Oil and Petrolatum by Means of A.S.T.M. Union Colorimeter (D 155 – 39 T), 1939 Book of A.S.T.M. Standards, Part III, p. 598.

[8] From test report 57968 of the National Bureau of Standards to A.S.T.M. Committee D-2 on Petroleum Products and Lubricants.

TABLE III.—COLOR OF TWO WHITE PAINTS BEFORE AND AFTER FOUR-MONTHS EXPOSURE.

	Paint No. 1				Paint No. 2			
	Exposed in Light		Exposed in Dark		Exposed in Light		Exposed in Dark	
	Original	Exposed	Original	Exposed	Original	Exposed	Original	Exposed
Settings with multipurpose reflectometer ($A_{45°, 0°}$) Blue (B)	0.7414	0.7269	0.7358	0.6991	0.7789	0.7360	0.7830	0.7304
Amber (A)	0.8557	0.8498	0.8578	0.8579	0.8691	0.8578	0.8661	0.8627
Green (G)	0.8333	0.8256	0.8339	0.8256	0.8488	0.8301	0.8480	0.8335
Change in $A_{45°, 0°}$		−0.0077		−0.0083		−0.0187		−0.0145
$A - G$	+0.0224	+0.0242	+0.0239	+0.0323	+0.0203	+0.0277	+0.0181	+0.0292
$G - B$	0.0919	0.0987	0.0981	0.1265	0.0699	0.0941	0.0650	0.1031
$0.4\ (G - B)$	0.0368	0.0395	0.0392	0.0506	0.0280	0.0376	0.0260	0.0412
$A + 2G + B$	3.2637	3.2279	3.2614	3.2082	3.3456	3.2540	3.3451	3.2601
α	0.0069	0.0075	0.0073	0.0101	0.0061	0.0085	0.0054	0.0090
β	0.0113	0.0122	0.0120	0.0158	0.0084	0.0116	0.0078	0.0126

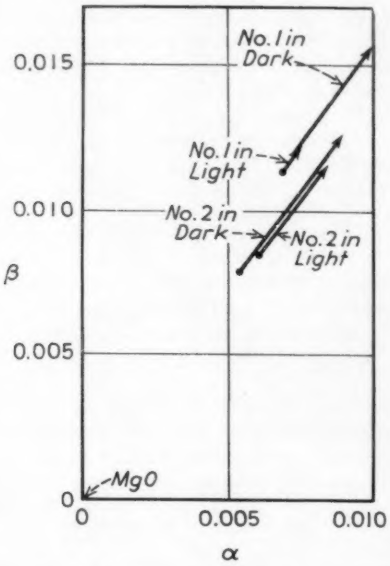

Fig. 3.—Part of (α, β)-Diagram Showing the Chromaticity Change Accompanying Yellowing of Two White Paints Both in the Light and in the Dark.

evaluation of amount of yellowing. The values of α and β were obtained from settings with the Hunter multipurpose reflectometer (*10*) and Eq. 3. Table III gives the instrument settings for two panels of each of the two paints both before and after the exposure for yellowing. It also shows the different quantities computed in order to find the values of α and β.

The changes of chromaticity of the paints are shown graphically on the plot of part of the (α, β)-diagram in Fig. 3. In this figure, an arrow connects the two points representing each panel before and after exposure; thus the length of arrow is a measure of amount of yellowing. One panel of each paint was kept four months in the dark, the other was exposed for four months in the light. With each paint, the two initial panels failed to match each other in color exactly. Each paint yellowed less when exposed to light than when kept in the dark; in fact the yellowing of paint No. 1 in the light was almost negligible. Paint No. 1 was initially yellower than paint No. 2, but it yellowed less on exposure. The chromaticity change accompanying yellowing, it may be noted, is represented on the (α, β)-diagram by nearly parallel vectors pointing toward the yellow region of the diagram.

Fading of Tinted Paints:

Fading of tinted paints may be numerically measured by the amount of migration toward the origin of the point in the (α, β)-diagram representing the paint. An example of the use of this method was given by Scofield and Cornthwaite (*15*) who tinted a number of paints with Prussian blue and exposed them outdoors at Washington, D. C. Inspection of the paints revealed that the colors became less saturated with exposure and it proved convenient to express the fading or loss of saturation by

$$F \text{ (in per cent)} = 100 \left(\frac{D_b - D_a}{D_b} \right)$$

where D_b and D_a are the distances from the origin to the points representing the paint before and after exposure, respectively. Data showing the changes in color of one paint as it faded are reproduced in Table IV. The reflectometer settings for this paint (A, G, and B), α and β, the distance of the point in the (α, β)-diagram from the origin ($\sqrt{\alpha^2 + \beta^2}$), and the "percentage fading" for the ten different days on which this paint was measured are given.

This method of measuring amount of fading would have to be modified for specimens which change markedly in hue angle or reflectance during fading. However, materials which change markedly in hue angle or reflectance during fading are in the minority and the proposed numerical method of measuring fading is therefore applicable to all but a small proportion of colored specimens. When this method proves inadequate, the complete color-difference formula referred to in the next section may be used.

Possible Use of the (α, β)-Tristimulus System for the Numerical Measurement of Amounts of Color Difference and the Quantitative Representation of Color Tolerances:

One of the most promising fields for application of a method of designating color such as that described herein is in the description and numerical measurement of color differences. Where there exists a suitable relation for measuring amounts of color difference between specimens from tristimulus values of the specimens, it is possible to measure and express color tolerances quantitatively.

Starting with the method of measuring color tolerances devised by Judd (*7*), methods which appear to be practical have been worked out for use with the tristimulus system described above. However, the explanation of these methods would require more space than is available here. They will instead be described in forthcoming papers (*14*, *16*).

Conclusion

It should be understood that the α, β, and A_{θ_1,θ_V} or T tristimulus system which has been described is not offered as the best ultimate system for recording the colors of the materials with which the A.S.T.M. deals. However, it is con-

TABLE IV.—FADING OF BLUE PAINTS EXPOSED AT WASHINGTON. AVERAGE OF 24 PANELS.

Age, days	Reflectometer Readings			Coordinates		Distance from Origin ($\sqrt{\alpha^2 + \beta^2}$)	Fading, F, per cent
	Blue	Amber	Green	α	β		
0	0.3135	0.0600	0.1225	−0.1011	−0.1235	0.1596	...
1	0.3090	0.0716	0.1322	−0.0940	−0.1096	0.1444	9.5
4	0.3138	0.0772	0.1359	−0.0886	−0.1074	0.1392	12.8
7	0.3138	0.0812	0.1391	−0.0860	−0.1038	0.1348	15.5
14	0.3122	0.0883	0.1452	−0.0824	−0.0967	0.1270	20.4
21	0.3347	0.1097	0.1716	−0.0785	−0.0828	0.1142	28.4
28	0.3374	0.1184	0.1800	−0.0755	−0.0772	0.1080	32.3
35	0.3488	0.1313	0.1953	−0.0735	−0.0705	0.1018	36.2
42	0.3563	0.1448	0.2108	−0.0715	−0.0631	0.0954	40.2
50	0.3719	0.1576	0.2264	−0.0700	−0.0591	0.0916	42.6

sidered to represent a considerable advance in the science of colorimetry and is therefore described for the benefit of those who wish to record color by a system more apt and convenient than any heretofore available. There is no reason why the Society should not take advantage of present developments rather than wait for the ultimate solution. The method of recording colors by α, β, and A_{θ_I,θ_V} or T possesses properties which merit its consideration and possible adoption by the Society as a tentative method for recording colors.

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(15) Francis Scofield and C. R. Cornthwaite, "Measurement of the Fading of Tints," *Scientific Section Circular, No. 548*, Nat. Paint, Varnish and Lacquer Assn., Washington, D. C. (1938).

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Symposium on Temperature Measurement and Control

LATE IN 1939 a three-day Symposium on Temperature—Its Measurement and Control in Science and Industry was held under the auspices of the American Institute of Physics with the cooperation of a number of other professional and technical organizations, including the A.S.T.M. and many others active in the field of materials. The National Bureau of Standards in particular contributed a great deal to the symposium and in the foreword to the 1362-page publication recently issued, special indebtedness is expressed to the Bureau.

Obviously, it is impossible in any short description of a 1300-page book to do more than give an outline. Certainly, this volume is ample evidence of the importance, particularly in a number of technical fields, of temperature. From the titles of the approximately 125 technical papers, one might conclude that there is hardly any field where temperature does not play some role.

The material is arranged in 13 chapters as follows: Temperature and Temperature Scales, Precision Thermometry, Education, Natural Sciences, Temperature in Biology, Temperature and Its Regulation in Man, Automatic Temperature Regulation and Recording, Special Applications and Methods, General Engineering, Metals and Ceramic Industries, Oil Industries, Optical and Radiation Pyrometry, and Thermometric Metals and Alloys.

In each chapter technical authorities have contributed a great deal of valuable information and data which have been studied, arranged, and edited by the publication committee. While a glossary of technical terms is included, no attempt was made to edit the papers to provide a uniformity of language.

Even though the sections devoted to general engineering, metals and ceramic industries, oil industries, and thermometric metals and alloys would be of particular interest to A.S.T.M. members, all portions of the book are valuable.

The appendix includes some 25 tables of data including a considerable amount on spectral emissivities, thermoelectric properties and resistance-temperature relations of metals and alloys, many of which are published for the first time as prepared principally by W. F. Roeser and H. T. Wensel, Pyrometry Section of the National Bureau of Standards.

Copies of this publication can be obtained from the Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y., at $11 per copy.

Textile Chemist and Colorist Year Book

THE 774-PAGE 1940 Year Book of the American Association of Textile Chemists and Colorists has been received. This is arranged in five parts, the first covering the organization setup of this association with information on officers, meetings, and by-laws. Part II comprising some 70 pages gives the committee reports, including the report of the research committee and a list of publications which are published in the American Dyestuff Reporter. The third part which is the most extensive portion of the Year Book comprises the standard A.A.T.C.C. test methods and gives various fastness tests, determination of shrinkage, water resistance, and other items. In particular, there are the analytical methods for a textile laboratory covering some 90 pages. Other parts of this Year Book give a tabulation of American dyes and information on textile chemical specialties and the membership roll of the association.

Copies of this publication can be obtained from the Secretary, Lowell Textile Institute, Lowell, Mass., at $3.50 each.

Sampling of Materials

By Glenn Murphy[1]

Basis of Sampling

Engineering materials are normally sold or purchased with the understanding that they meet previously established requirements. In most instances it is not feasible to check all of the material or each unit of a consignment, so the usual procedure is to accept or reject the entire consignment on the basis of the results obtained from controlled tests on a few samples that are believed to be representative. Thus, the acceptance or rejection of several thousand pounds or units of a material or a commodity often depends upon the results secured from tests on only a few pieces or samples selected from the entire lot. As was pointed out by Dudley,[2] three requirements must be met before the use of a sample as a criterion for the quality of a consignment of material can be justified. The sample must be representative, selected at random, and selected by a representative of the consumer. While the two latter requirements may be satisfied readily, the selection of a representative sample raises some questions.

If all of the units in a group were identical, any one unit would constitute a representative sample. However, in no case will all units be identical; hence, the most that may be expected of a sample is that it shall have properties which give an accurate indication of the average properties of the group. The tolerances for acceptance or rejection of the material must therefore be sufficiently broad to allow for the incidental variations of properties that normally may be expected for that type of material, as well as for the inevitable variations introduced in the testing procedure. Since a reasonable range of variation must be established before the specifications can be formulated, it is evident that there are two phases of materials testing: One, research, or the evaluation of representative values of the properties of a given class of material, so that standards and tolerances may be established intelligently; the other, routine testing, or the determination of whether or not given samples meet the requirements stipulated in established specifications.

In research, the problem is to establish the most probable value of the properties and also the spread of values that may be expected under normal conditions. The question of acceptance or rejection is not usually present. In some instances the specimens are supposedly identical; in other cases the effect of some known variable upon the properties is desired. Various techniques for the analysis of the test data are recorded in the literature.[3]

In establishing the most probable value of a property of a given class of material, as, for example, the ultimate tensile strength of structural grade, billet-steel concrete reinforcing bars, manufactured and tested under controlled conditions, a number of tests are made on similar specimens.[4] If the result from each of the specimens is equally dependable, the most probable value of the ultimate tensile strength is evaluated simply as the numerical average of the individual values obtained for the strength; that is,

$$S_a = \frac{\Sigma S_i}{n} = \frac{S_1 + S_2 + S_3 + \ldots S_n}{n}$$

where S_a = most probable value of the strength,
ΣS_i = sum of the strengths of the individual specimens, and
n = number of specimens tested.

The strength of any one of the specimens from the lot tested has a 50-50 chance of falling within the band of strengths defined by the following equation:

$$S = \sqrt{\frac{2}{n}\left[(S_a - S_1)^2 + (S_a - S_2)^2 + \ldots (S_a - S_n)^2\right]}$$

If the value of S_a is representative of the material, as well as of the samples tested, the strength of any specimen of the steel made and tested under the same controlled conditions also has a 50-50 chance of falling within the band indicated.

If the specimens are not identical, but differ by one variable, an approximate (and often sufficiently accurate) relationship between the measured property and the variable may be secured from the curve obtained by plotting values of the property against the corresponding values of the variable. If a sufficient number of samples has been tested, a more accurate relationship may be developed by the method of least squares.

The second phase of testing, that of inspecting for purposes of acceptance or rejection, is the more common. The purchaser of a consignment of material usually is not interested in the exact properties of all of the units in, or of all portions of, the consignment, but only in knowing whether or not all units in the consignment meet the previously established requirements,[5] and, if not, which units are unsatisfactory. If all units meet the requirements, any one sample, selected at random, will be entirely representative (as far as the needs of the purchaser are concerned) and will give the correct information, even though its properties may be widely different from the average of the group. If, in a group of 100 units, one unit does not

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Associate Professor of Theoretical and Applied Mechanics, Iowa State College, Ames, Iowa.

[2] Charles B. Dudley, "Factors and Principles Involved in the Enforcement of Specifications," *Proceedings*, Am. Soc. Testing Mats., Vol. 7, p. 19 (1907).

[3] A convenient source of information is the A.S.T.M. Manual on Presentation of Data, Third Printing, August, 1940, reprinted March, 1941.

[4] A technique for establishing the minimum number of specimens necessary to produce results within a maximum limiting percentage of error has been presented by R. W. Crum, "The Number of Specimens or Tests of Concrete and Concrete Aggregates Required for Reasonable Accuracy of the Average" in the Report on the Significance of Tests of Concrete and Concrete Aggregates (1935). (Report available in separate pamphlet form as published by the Society.)

[5] In most cases the requirement is stated as a minimum permissible value. For example, the Standard Specifications for Billet-Steel Bars for Concrete Reinforcement (A 15 – 39), 1939 Book of A.S.T.M. Standards, Part I, p. 89, require that the ultimate strength of the hard grade bars be not less than 80,000 psi. Above this minimum limit, strengths may vary widely from the average for the group.

meet the requirements and the other 99 units do, no one sample (or no series of samples, short of 100) is representative of the entire group. If only one sample is selected, the chances of obtaining one that will be representative of 99 per cent of the units in the group is 99 in 100, and the probability of obtaining the one that is representative of only 1 per cent of the units in the group is 1 in 100, if the sample is selected at random. In other words, with a single sample, the purchaser stands a 99 to 100 possibility of getting a result that is 99 per cent correct, and a 1 per cent chance of getting a result that is representative of only 1 per cent of the units. The selection of two samples instead of one insures getting at least one that is representative of 99 per cent of the material and gives a 2 per cent chance of getting one that is representative of only 1 per cent of the material. Selection of additional samples increases the chances of getting a representative set, but an entirely representative set of samples cannot be obtained until all of the units in the group are selected as samples.

If, of the 100 units, only 50 meet the minimum requirements, no single sample gives a correct indication of the nature of the units. A representative sample must contain an equal number of satisfactory and unsatisfactory specimens. In selecting a single sample at random, the purchaser has equal chances of picking one that meets the requirements or of picking one that does not meet the requirements, and any single sample is representative of only 50 per cent of the material. If the purchaser selects two samples, however, he stands equal chances of getting two that are alike or two that are unlike. The two unlike samples are representative of the entire group, while the similar ones are representative of only 50 per cent of the group. In this example, therefore, there are equal chances of selecting entirely representative specimens or of selecting specimens which are representative of only 50 per cent of the group. In the case where only one sample is selected, it is impossible to get a single representative specimen. Therefore, an increase in the number of samples increases the possibility of obtaining a representative set of samples, but again, absolute assurance of a representative set is not obtained until the entire group is included in the sample.

In some cases the purchaser desires to know whether or not the units in the group meet both minimum and maximum requirements. For example, the Standard Specifications for Billet-Steel Bars for Concrete Reinforcement (A 15 – 39) of the American Society for Testing Materials[6] require that the ultimate tensile strength of structural grade billet-steel reinforcing bars shall be between 55,000 and 75,000 psi. As in the case where only a lower limit is specified, if all units meet the requirements any unit is representative. If only part of the units meets the requirements, the possibility of obtaining a representative sample or group of samples is the same as in the case where only a minimum requirement is stipulated. In neither case is it possible to detect the nonacceptable units without testing the entire group.

In the preceding examples in which acceptance or rejection is based on whether or not the units meet minimum requirements, the minimum number of samples that could be representative, that is, have the same relative number of acceptable units, is equal to the total number of units divided by the number of the acceptable or the nonacceptable units, whichever is the smaller, that is,

$$s = \frac{n}{r} = \frac{a + r}{r} = 1 + \frac{a}{r}$$

where s = minimum number of units in a representative sample,
n = total number of units in the group,
a = number of acceptable units, and
r = number of nonacceptable units, ($r < a$).

The selection of the minimum number of samples in no way assures the purchaser that the selection will contain the proper distribution to be representative. In the case just discussed, where only one half of the material met the minimum requirements, selection of the minimum number of samples provides only a 50–50 chance that the two samples are representative.

Before the minimum number of representative samples for a given material can be established, the number of acceptable samples which would normally be found in a group of that material must be known, this information being determined by previous research. The size of the sample may then be based on the normal distribution with the assumption that the normal distribution also exists in the samples.

Methods of Sampling

The methods of sampling and the techniques used to assist in obtaining representative samples depend upon the nature of the tests, and upon the type of material, or units being tested. Tests may be classified as destructive or nondestructive. Destructive tests include those which result in failure of the material by slip, creep, or fracture. They constitute the usual type of test used in the determination of physical properties. Nondestructive tests, or tests that do not impair the usability of the units, are frequently made on structural units or machine parts. They may consist in simple visual examinations for defects, or in checking dimensions, as is done for parts such as springs and car wheels. Electrical and magnetic tests, X-ray and radiographic methods, and some types of hardness tests are other examples of nondestructive tests.[7] In general, more samples may be examined when nondestructive tests are used than when destructive tests are necessary.

For purposes of classification on the basis of the method of sampling, materials may be considered as being (1) discrete units, such as brick, tile, or springs, which are tested as units; or (2) aggregate units, such as wire, rod, sheet material, coal, cement, and sand, from which samples constituting a portion of the whole must be selected. The aggregate units may be classified on the degrees of freedom of motion involved in making the selection of the sample, as follows:

Three-dimensional units such as coal, sand, or cement in bulk;

Two-dimensional units such as sheet and plate material; and

One-dimensional units such as wire and rod.

In order to obtain a representative sample of a three-dimensional unit of material such as coal or gravel, which

[6] 1939 Book of A.S.T.M. Standards, Part I, p. 89.

[7] A summary of nondestructive testing is given by H. H. Lester, R. L. Sanford and N. L. Mochel, in their paper on "Nondestructive Testing in the United States of America," ASTM Bulletin, No. 95, December, 1938, pp. 5–13; and No. 96, January, 1939, pp. 13–18.

may vary greatly in properties throughout the mass of material to be sampled, a number of small samples of the material are collected from all parts of the mass by means of test pits, sampling tubes, or similar devices, or by the grab method. The assembled samples are thoroughly mixed, quartered, a quarter remixed, and requartered until a sample of the size required for testing is obtained. Such procedures are described in the Tentative Methods of Sampling Stone, Slag, Gravel, Sand, and Stone Block for Use as Highway Materials (D 75 – 40 T),[8] Standard Methods of Sampling and Physical Testing of Portland Cement (C 77 – 40),[9] and of Sampling Coal for Analysis (D 21 – 40)[10] of the American Society for Testing Materials.

Sheet and plate materials 2 in. and under in thickness are usually sampled by selecting specimens that are the full thickness of the plate, while specimens from thicker plates are machined with the axis of the specimen midway between the center and the top or bottom surface. Since the forming process may impart directional properties to the material, it is often necessary to specify definitely the direction of the axis of tensile and bend test specimens. The Standard Specifications for Boiler and Firebox Steel for Locomotives (A 30 – 39) of the American Society for Testing Materials,[11] which are typical of the specifications for steel plate, require that the tension specimens shall be taken longitudinally from the bottom of the plate as rolled and bend test specimens shall be taken transversely from the middle of the top of the plate as rolled. On the other hand, the Tentative Specifications for Aluminum-Alloy (Duralumin) Sheet and Plate (B 78 – 40 T) of the American Society for Testing Materials[12] state that for sheet in the tempers specified, the tension test specimens may be taken in any direction.

Since the composition and properties may not necessarily be the same throughout the cross-section of sheet or plate materials, the location from which the test specimen is selected is important in many cases. For example, both the Standard Specifications for Carbon-Steel Plates for Stationary Boilers and Other Pressure Vessels (A 70 – 39)[13] and the Standard Specifications for High Tensile Strength Carbon-Silicon Steel Plates for Boilers and Other Pressure Vessels (A 212 – 39)[14] of the American Society for Testing Materials require that "tension test specimens for firebox steel shall be taken from the top and bottom corners of the plate as rolled, parallel to its longitudinal axis, and for flange steel from the bottom corner of the plate only."

Wire, rod, bars, rope, and similar one-dimensional units of material are sampled by cutting appropriate lengths from the material. Usually the test lengths are cut from one end of one or more representative units (such as a spool of wire) of the quantity of material being sampled.

The numbers of samples to be taken to represent definite quantities of material are prescribed in the specifications and methods of test of the American Society for Testing Materials. A few examples are given in Table I.

In practically all cases, the specifications stipulate visual inspection of the material to eliminate portions which are obviously defective, thus increasing the general uniformity of the material to be considered in sampling. The number of samples listed for each of the materials in Table I indicates the number which is regarded by the American Society for Testing Materials as sufficient to give satisfactory results, that is, results that are in general representative of the lot of material from which each sample is selected.

TABLE I.

Material	Size of Sample	Maximum Quantity Represented	A.S.T.M. Specification or Method of Test
Structural steel	2 tension, 2 bend specimens	1 melt	A 7 – 39[15]
	1 tension, 1 bend specimen	30 tons	
Reinforcing rods	1 tension, 1 bend specimen	1 melt	A 15 – 39[6]
Malleable iron castings	3 specimens	1 melt	A 47 – 33[15]
Steel pipe	1 specimen	500 lengths	A 53 – 40[16]
Helical springs	1 spring	10 springs	A 61 – 39[15]
Track spikes	1 spike	5 tons	A 65 – 33[15]
Firebox steel plate	2 tension, 2 bend specimens	1 plate	A 89 – 39[15]
Flange steel plate	1 tension, 1 bend specimen	1 plate	A 89 – 39[15]
Barbed wire	1 specimen	50 spools	A 121 – 39[15]
Nickel copper alloy sheet	1 specimen	500 lb.	B 127 – 39 T[15]
Drain tile	5 tile	[a]	C 4 – 24[17]
Brick	5 brick	50 000	C 67 – 39[17]
Cement	8 lb.	400 bbl.	C 77 – 40[9]
Coal	1000 lb.	500 tons	D 21 – 40[10]
Sand	10 lb.	50 tons	D 75 – 40 T[8]
Gravel (2½-in.)	100 lb.	50 tons	D 75 – 40 T[8]

[a] Specimens of tile may be selected by the inspector in such number as he judges necessary to determine fairly the quality of all the tile.

One of the most delicate problems in testing arises when a shipment is rejected on the basis of the samples tested, and the producer demands resampling and retesting, contending that the samples tested were not representative. Charles B. Dudley[18] covers the situation in no uncertain terms in citing his own philosophy and practice on the subject of sampling:

"The sample is but a very small fragment of the shipment, and a doubt may fairly be felt as to whether the whole shipment is like the sample. It is obvious that if the specification is intelligently drawn all the variations in the material, due to uncertainties in the process of manufacture or unavoidable errors of manipulation, are provided for in the sampling which it directs. This leaves only intentional or unintentional variations, introduced by the producer, to be provided against. Our position in regard to these has always been that if the producer was willing to take the risk of our getting our sample from one of these intentionally inferior parts of the shipment, with the rejection which would inevitably follow, we were willing to take the chance of getting a sample from a better part of the shipment, with the consequent acceptance of some inferior material. . . ."

"Our theory is that the material ought all to be of the grade called for by the specifications, since this is what the consumer has bargained for, and if this is the actual fact one sample is as good as fifty. We are quite well aware that there are many specifications in force which provide for second and, if need be, third tests, the fate of the shipment to be decided by the majority. But this has for a

[8] 1940 Supplement to Book of A.S.T.M. Standards, Part II, p. 276.
[9] *Ibid.*, p. 27.
[10] 1940 Supplement to Book of A.S.T.M. Standards, Part III, p. 1.
[11] 1939 Book of A.S.T.M. Standards, Part I, p. 37.
[12] 1940 Supplement to Book of A.S.T.M. Standards, Part I, p. 320.
[13] 1939 Book of A.S.T.M. Standards, Part I, p. 41.
[14] *Ibid.*, p. 60.

[15] 1939 Book of A.S.T.M. Standards, Part I.
[16] 1940 Supplement to Book of A.S.T.M. Standards, Part I.
[17] 1939 Book of A.S.T.M. Standards, Part II.
[18] "The Enforcement of Specifications," Annual Address by the President, *Proceedings*, Am. Soc. Testing Mats., Vol. VII, p. 32 (1907).

long time seemed to us to be a survival of the crude early days of testing, when neither producer or consumer knew much about materials and which it is high time should be banished forever. If a specification is so severe that only two-thirds of well-made material will stand test, the specification should be changed and if a manufacturer can only make a product, two-thirds of which will stand test, he should either learn how to improve his product or go out of business. Testing was never intended to be a device to bring about the acceptance of inferior material; but quite the contrary. Moreover, from three samplings and tests it is but a step to five or seven or nine and perhaps if sampling and test is long enough indulged in a majority may ultimately be found which will always bring acceptance of the material. Surely the interests and responsibilities of the consumer cannot be trifled with in this manner.

"But some one says, are you so sure that you are right in your single test that you feel that you are on firm ground in rejecting material and cutting off all chance for further tests? We reply that is quite another matter. Retesting because the material fails, no question being raised in regard to the reliability of the tests, is entirely different from a retest because there is reason to think there is something wrong with the sampling or testing. In this case the burden of proof is on the producer and it is incumbent on him to show reasonable ground for reopening the case. On the other hand, it is equally essential that the consumer should welcome the investigations of the producer; should throw everything open to him, and give him every facility for satisfying himself that no injustice has been done. There is no room for a star chamber in the enforcement of specifications. In our own laboratory, we always keep the sample of every rejected shipment for a month and are always ready to give the producer half of our sample for verification purposes."

The finality of Dudley's attitude is more than many consumers care to accept. The willingness to compromise in the face of such logic is doubtless due, in most cases, to a desire to adopt an attitude less likely to seem antagonistic to the producer, especially if the consumer has some lack of confidence in the infallibility of his specifications and his tests.

Specifications for chemical analyses frequently provide for the selection of a large sample which is divided into three parts: one for the consumer, one for the producer, and the third for an umpire if necessary. If the results obtained by the first two parties do not establish or dismiss the claim to the satisfaction of both, the third sample is submitted to a mutually agreeable umpire whose findings are taken as final.

Whether sound or unsound, the practice of permitting resampling and retesting is too well established to be ignored. If retesting is to be permitted it seems reasonable that the number of additional samples to be tested should be at least twice the original number specified. The final decision regarding acceptance or rejection should then be made on the basis of the two out of three showing rather than on the basis of the retests alone.

Regardless of whether retests are permitted the whole technique of sampling and testing must always be zealously guarded lest it be reduced to a farcial search for "a sample that will pass."

In nondestructive testing, the percentage of samples investigated may be much higher than when destructive methods are used. The use of magnetic and vibratory tests for detecting cracks and other imperfections in important machine parts, and the Sperry car, widely used to detect fissures in railroad rails, are examples of techniques which are becoming increasingly popular. Some of the hardness tests, such as the scleroscope and Rockwell, are also used for the examination of large numbers of metal units. However, they also embody the element of sampling, since the tests are made only at a relatively few random or specified locations on the surface of each unit.

While no sampling process is fool-proof, the techniques that have been developed are believed to be giving satisfactory results, which for the most part provide maximum protection for the purchaser at a minimum of expense for testing.

Complete sampling, involving the testing of every essential part of every unit which is to be used, will not be possible for all materials until some simple, reliable, inexpensive, nondestructive test is developed. At present, X-ray examination shows promise of filling a need for special materials, but as yet it is too expensive for general routine examination of materials, even for those uses to which it can be adapted.

Progress in Specifications for Cast-Iron Pipe

A RECENT MEMORANDUM in connection with current progress of the Sectional Committee on Specifications for Cast-Iron Pipe, organized under the A.S.A. procedure and sponsored by four societies, American Gas Association, American Water Works Association, New England Water Works Association, and A.S.T.M., indicates that specifications for four types of pipe other than pit-cast pipe have been drafted, based to a large extent on the specifications for Cast-Iron Pit-Cast Pipe for Water and Other Liquids (A 44 – 39 T), ASA No. A21.2-1939. These pipes would be centrifugally cast in metal molds and in sand-lined molds, and material horizontally cast in green sand with multiple gates and in green sand having tapered machined bolted joints. These drafts have received the consideration of producers and consumers and the technical subcommittee concerned.

To make a number of the requirements for pit-cast pipe adaptable for the needs of the gas industry, certain work has been accomplished which it is expected will result in recommendations to the sectional committee.

Standardized requirements for tar-dip coatings have been approved by the section in charge and will be offered to the main committee.

A joint committee formed of members of Sectional Committee A40 and A21 has completed a draft of proposed specifications for threaded cast iron pipe for drainage, vent and waste services. This draft is receiving informal consideration by members of the two sectional committees preliminary to its presentation for ratification.

Specifications on Dehydrated Castor Oil

By I. M. Colbeth[1]

Mr. Colbeth presented the following paper to Subcommittee II on Drying Oils of Committee D-1 on Paint, Varnish, Lacquer, and Related Products at its meeting in Washington on March 3, 1941. The subcommittee felt that the interest in the subject dealt with in this paper was sufficiently widespread and the presentation was sufficiently thorough to justify publication, and has, accordingly, authorized publication in the ASTM BULLETIN.

Francis Scofield,
Chairman, Subcommittee II

DEHYDRATED castor oil is rapidly becoming a factor in the field of drying oils, and as a result there is a growing demand from the trade for specifications to cover this type of product. In order to arrive at specifications that will protect the buyer and not unnecessarily restrict the manufacturer of these oils, this paper has been prepared as a starting point.

The term "dehydrated castor oil" is being used in the trade to describe a number of products valuable for use as drying oils which can be prepared from castor oil. In fixing the specifications for these oils consideration should first be given to the nature of the product included in the term "dehydrated castor oil."

From an intimate knowledge of the production of oils of this type and also from a knowledge of the products now being offered for sale, we can divide the materials known as dehydrated castor oils into two groups:

A—Oils prepared entirely from castor oil by means of a catalyst.

B—Oils derived from castor oil which may or may not contain other oils but which differ from group *A* in that they involve factors other than simple dehydration.

Since it is possible to produce drying oils from castor oil in so many ways, specifications wide enough to include all types would be very broad. In fact, if we were to include all of the drying oils derived from castor oil in the term dehydrated oil, the term would lose its significance. Each producer of dehydrated castor oil has endeavored to coin a name to describe his product but no one has found a name that would amply cover all types.

Since any of a large number of vegetable oils may be blended with castor oil or processed together with castor oil to obtain a product with valuable drying properties, even though a part of such a product might be a true dehydrated type, it is my opinion that we should disregard oils which are blends as being outside the scope of these specifications.

In considering the dehydrated oils that may be formed by the aid of catalysts, they may be classified into two groups:

1. Oils which are produced by catalysts that can be removed from the oil.
2. Oils which can be produced by means of catalysts which remain in the oil in solution or in combination with the oil.

These two groups constitute the bulk of the most important drying oil products that can be prepared from castor oil.

We have studied a large number of samples representing these oils which have been obtained in the market from companies offering them for sale. In other words, the samples are such as would be obtained by a purchaser and have not been selected for any particular property. The list includes the following trade names:

Isoline	Castung 101 and 102
Synthenol	Trienol
Dehydrol	Dienol
Kast-O-Lene	Synouryn
Baker's No. 304 Oil	P. G. D. Oil
Castung 403	Collanol

A study of the analyses of these oils given in Table I indicates that they may be further divided into two groups, bodied and unbodied oils. We suggest designating as unbodied oils those having viscosities less than *J* (2.5 poises) and bodied oils those having viscosities heavier than *J*.

It is the opinion of the author that the most important constants to be considered when evaluating dehydrated oil are the following in order of their importance:

Viscosity
Iodine value
Refractive index
Acetyl value
Color
Acid value
Moisture
Suspended matter
Ash

In addition to these chemical constants, there should be added to this list the following:

Bodying rate
Gelling time
Drying time

I do not believe that it is necessary to suggest tests based on varnish performances, such as water resistance and alkali resistance, as such tests would largely depend upon the skill of the operator and the selection of the resin, and would therefore be of questionable value.

With reference to the results given in Table I, we would suggest adopting those methods already known to the varnish trade or suitable A.S.T.M. methods, for example:

Viscosity—Gardner-Holdt tubes.

Iodine Value—Wijs solution should be used with a definitely specified excess of iodine since the percentage of

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Chemical Director, The Baker Castor Oil Co., New York, N. Y.

TABLE I.—DEHYDRATED CASTOR OIL.

Color, Lovibond	Viscosity at 25 C., poises[a]	Specific Gravity at 15 C.	Refractive Index at 25 C.	Free Fatty Acid, per cent	Saponification Value	Acetyl Value	Iodine Value	Neutralization Value
Oil No. 1								
40.Y	39.00	0.957	1.4861	1.58	186.80	13.61	112.95 (Wijs)	3.16
45.Y	40.00	0.952	1.4863	0.95	189.50	4.55	119.15 (Hanus)	1.90
45.Y	36.00	0.952	1.4865	0.84	186.10	10.80	119.00 (Wijs)	1.68
Oil No. 2								
9.00Y 1.75R	G	0.932[b]	1.4820	1.01	190.10	10.50	139.30	2.02
4.50Y 1.00R	G-H	0.932[b]	1.4820	0.95	190.60	15.00	142.50	1.90
5.00Y 1.50R	G-H	0.933[b]	1.4820	1.01	189.50	19.20	140.30	2.02
4.00Y 1.00R	G-H	0.933[b]	1.4819	0.95	190.60	16.30	141.40	1.90
7.00Y 1.50R	Z-3	0.952[b]	1.4868	1.01	189.00	6.85	124.50	2.02
5.80Y 1.50R	Z-3.5	0.951[b]	1.4870	0.45	190.00	4.50	123.70	0.90
5.80Y 1.50R	Z-3.5	0.951[b]	1.4870	0.56	189.20	3.70	121.00	1.12
5.80Y 1.50R	Z-3.5	0.951[b]	1.4870	0.45	188.60	3.10	124.90	0.90
Oil No. 3								
35.Y	1.86	...	1.4815	0.95	189.30	16.55	136.25 (Wijs)	1.90
60.Y	2.36	...	1.4819	1.01	....	29.90	129.70 (Wijs)	..
	56.00	...	1.4872	..	188.40	...	94.10 (Wijs)	..
55.Y	43.50	...	1.4863	3.64	187.00	4.00	109.40	..
Oil No. 4								
4.5Y 1.R	G-H	0.933[b]	1.4820	0.90	190.90	13.90	138.90	1.80
4.5Y 1.R	G-H	0.933[b]	1.4820	0.90	190.10	15.60	141.30	1.80
5.Y 1.R	G-H	0.933[b]	1.4820	0.90	192.40	13.30	139.30	1.80
4.5Y 1.R	G-H	0.933[b]	1.4820	0.90	190.90	13.90	138.90	1.80
6.Y 1.R	Z-3.5	0.953[b]	1.4869	0.84	189.30	2.70	120.90	1.69
6.5Y 1.R	Z-3	0.952[b]	1.4868	0.73	189.40	4.70	118.20	1.90
5.8Y 1.R	Z-3.5	0.953[b]	1.4870	0.95	190.30	3.20	121.40	1.90
6.5Y 1.5R	Z-4	0.953[b]	1.4869	0.78	189.90	3.70	121.80	1.56
Oil No. 5								
40.Y	90.1	0.949	1.4854	1.12	197.65	14.08	120.65 (Wijs)	2.24
30.Y	32.0	...	1.4879	2.41	190.70	6.53	105.45 (Hanus)	4.82
Oil No. 6								
105.Y	60.2	...	1.4871	4.77	185.65	1.63	122.05 (Hanus)	9.54
75.Y	1.4	0.933	1.4814	2.86	190.25	6.20	137.15 (Hanus)	5.72
Oil No. 7								
35.Y	45.5	0.948[c]	1.4881	..	195.65	3.51	113.25 (Wijs)	1.12
19.Y 3.R	36.7	...	1.4882	0.95	191.45	9.10	115.90 (Wijs)	1.90
20.Y 3.5R	11.2	...	1.4866	1.28	192.95	5.25	121.45 (Wijs)	2.56
45.Y	38.0	0.948[d]	1.4871	1.96	189.00	10.50	118.40 (Wijs)	3.92
18.2Y 4.0R	46.5	0.949[e]	1.4880	1.58	187.15	11.81	117.40 (Wijs)	3.16
Oil No. 8								
4.00Y 1.00R	G-H	0.933[b]	1.4820	1.28	189.60	15.00	135.00	2.56
6.00Y 1.50R	Z-3 to Z-4	0.951[b]	1.4868	2.08	190.00	3.10	120.00	4.36
Oil No. 9								
75.Y	46.30	0.946	1.4865	0.84	186.65	2.45	103.25	1.68
60.Y	27.00	0.946	1.4864	0.84	187.00	3.50	109.45	1.68
55.Y	22.70	0.943	1.4860	0.84	187.60	4.90	110.00	1.68
60.Y	3.20	0.944	1.4839	0.55	187.55	6.20	114.50	1.12
55.Y	3.20	0.944	1.4840	0.84	185.90	6.40	125.55	1.68
75.Y	1.30	0.927	1.4821	2.24	189.45	10.10	132.80	4.48
95.Y	1.50	0.936	1.4816	1.98	190.40	17.00	142.50 (Wijs)	3.96
Oil No. 10								
30.Y	1.82	0.938	1.4819	0.95	189.30	16.50	137.10	1.90
25.Y	1.65	0.938	1.4818	1.23	191.10	11.60	136.10	2.46
40.Y	1.62	0.939	1.4818	1.06	187.80	15.23	135.50	2.12
30.Y	2.11	0.936	1.4816	1.01	181.65	19.26	139.40	2.02
50.Y	59.80	0.951	1.4869	2.30	187.30	5.70	121.00	4.60
50.Y	63.40	0.953	1.4869	2.52	184.30	6.00	120.50	5.04
50.Y	63.40	0.954	1.4868	2.25	186.80	6.00	122.30	4.50
35.Y	65.00	0.952	1.4867	2.80	185.50	5.80	121.90	5.60
Oil No. 11								
180.Y	1.25	0.942	1.4805	3.25	188.09	33.1	130.04 (Wijs)	6.50
180.Y	1.25	0.942	1.4805	3.00	187.50	33.1	129.03 (Wijs)	6.00
60.Y	3.00	0.942	1.4818	1.96	186.20	15.9	126.50 (Wijs)	3.92

Color, Lovibond	Viscosity at 25 C., poises[a]	Specific Gravity at 15 C.	Refractive Index at 25 C.	Free Fatty Acid, per cent	Saponification Value	Acetyl Value	Iodine Value	Neutralization Value
Oil No. 12								
285.Y	1.80	0.940	1.5103	5.89	189.20	12.90	156.30 (Wijs)	11.78
Oil No. 13								
125.Y	7.0	0.944	1.4814	2.57	189.30	54.20	124.60 (Wijs)	5.14
65.Y	30.0	0.952	1.4848	2.97	185.80	5.90	121.20 (Wijs)	5.94
190.Y	5.31	0.945	1.4813	2.13	183.10	19.94	122.90 (Wijs)	4.26
55.Y	23.10	0.955	1.4850	1.75	187.90	12.28	119.40 (Wijs)	3.50

[a] The letters G, G-H, Z-3, etc., correspond with the tubes of the Gardner-Holdt viscosity standards.
[b] Specific gravity at 25 C. [d] Specific gravity at 26 C.
[c] Specific gravity at 15.5 C. [e] Specific gravity at 28 C.

iodine is very critical. The time of contact of the reagent with the oil is also of great importance.

Refractive Index—Abbe refractometer or any method which can accurately give the refractive index correct to four decimal places.

Acetyl Value—The acetyl value requires some comments. The Andre Cook method and the method described by Lewkowitsch and also the method involving the use of pyridine (West, Hoagland, Curtiss Method) all yield apparent acetyl values. By this I mean values that include all of the water-soluble acids that may be present in the oil, some of which react with the acetic anhydride in the same way as the hydroxyl groups. This test as now determined may give values that are high due to the presence of mono and diglycerides. For these reasons the use of acetyl values is not recommended for evaluating the degree of dehydration without making a correction for water-soluble acids other than acetic which may be present in the fat. We therefore suggest that the acetyl value should be corrected by the amount equivalent to the water-soluble acids present. It would also serve as a guide for the presence of decomposition products, soluble catalysts, etc.

Color—Gardner 1933 or Lovibond method.

Acid—A.S.T.M. Standard Methods of Testing Drying Oils (D 555 – 39).[2]

Moisture—A.S.T.M. D 555 – 39.[2]

Suspended Matter—Skins, etc.—For example, the method of the American Oil Chemists Assn. on cottonseed oil might be valuable.

Ash—A.S.T.M. Standard Methods of Analysis of Grease (D 128 – 40)[3]—modifying by using a larger sample.

I would suggest in conclusion that since these so-called dehydrated oils are all very new, until we become better acquainted with them the specifications suggested below should insure the best oils of the dehydrated type that are obtainable:

UNBODIED DEHYDRATED CASTOR OIL

Color	3.00Y	200.00Y
Viscosity at 25 C.	G	J
Specific gravity at 25 C	0.933	0.935
Refractive index at 25 C	1.4815	1.4825
Free fatty acid, per cent	0.50	1.25
Saponification value	188.00	192.00
Iodine value	135.00	145.00
Neutralization value	1.00	2.50

BODIED DEHYDRATED CASTOR OIL

Color	3.00Y	200.00Y
Viscosity at 25 C.	J	Any desired value
Specific gravity at 25 C	0.950	0.955
Refractive index at 25 C	1.4865	1.4875
Free fatty acid, per cent	0.50	1.25
Saponification value	188.00	192.00
Iodine value	110.00	125.00
Neutralization value	1.00	2.50

[2] 1939 Book of A.S.T.M. Standards, Part II, p. 718.
[3] 1940 Supplement to the Book of A.S.T.M. Standards, Part III, p. 53.

After discussion of this report, Subcommittee II of Committee D-1 voted to publish the following proposed specifications for the analytical constants of dehydrated castor oil, for purposes of information and discussion. The subcommittee realizes that physical tests will be a necessary part of a satisfactory specification for dehydrated castor oil, but pending the development of such tests it seemed that a specification of the analytical constants might be useful.

PROPOSED SPECIFICATIONS FOR THE ANALYTICAL CONSTANTS OF DEHYDRATED CASTOR OIL[1]

These are proposed specifications and are published as information only. Comments are solicited and should be addressed to the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Scope

1. These specifications cover a drying oil made from castor oil by dehydration. Two types are covered, unbodied and bodied.

Properties

2. Dehydrated castor oil shall conform to the following requirements:

	Unbodied Oil	Bodied Oil
Viscosity, poises	2.5 to 1.6	2.5 min.
Acid number, max.	2.5	2.5
Iodine number (Wijs), min.	135.0	110.0
Refractive index at 25 C., min.	1.4815	1.4865
Drying time of oil containing 0.25 per cent lead and 0.05 per cent manganese as naphthenates, max., hr.	18	18

[1] These proposed specifications are under the jurisdiction of the A.S.T.M. Committee D-1 on Paint, Varnish, Lacquer, and Related Products. Published as information, May, 1941.

Methods of Testing

3. (*a*) The properties enumerated in these specifications, with the exception of viscosity, shall be determined in accordance with the Standard Methods of Testing Drying Oils (A.S.T.M. Designation: D 555) of the American Society for Testing Materials.[2]

(*b*) Viscosity shall be determined in accordance with the Standard Methods of Testing Oleoresinous Varnishes (A.S.T.M. Designation: D 154) of the American Society for Testing Materials.[3]

[2] 1939 Book of A.S.T.M. Standards, Part II, p. 718.
[3] *Ibid.*, p. 762.

A Nomogram for Flexural Strength

By I. L. Hopkins[1]

In the May 1939 issue of the ASTM Bulletin we presented a nomogram to aid in the computation of flexural strength and modulus of elasticity of standard $^1/_2$ by $^1/_2$ by 5-in. test bars tested on a 4-in. span. By entering the nomogram with the dimensions of the cross-section of the specimen, two form factors were obtained which when multiplied by the maximum load and a certain function of the load-deflection ratio, yielded, respectively, the strength and the modulus of elasticity.

For testing programs not requiring the modulus of elasticity, it appears desirable to have a new nomogram which will permit a greater range of specimen dimensions and also yield the final answer in terms of flexural strength rather than a form factor to be multiplied by the load in a separate operation. The accompanying nomogram does this. It gives a solution to the formula

$$F = \frac{6W}{BH^2}$$

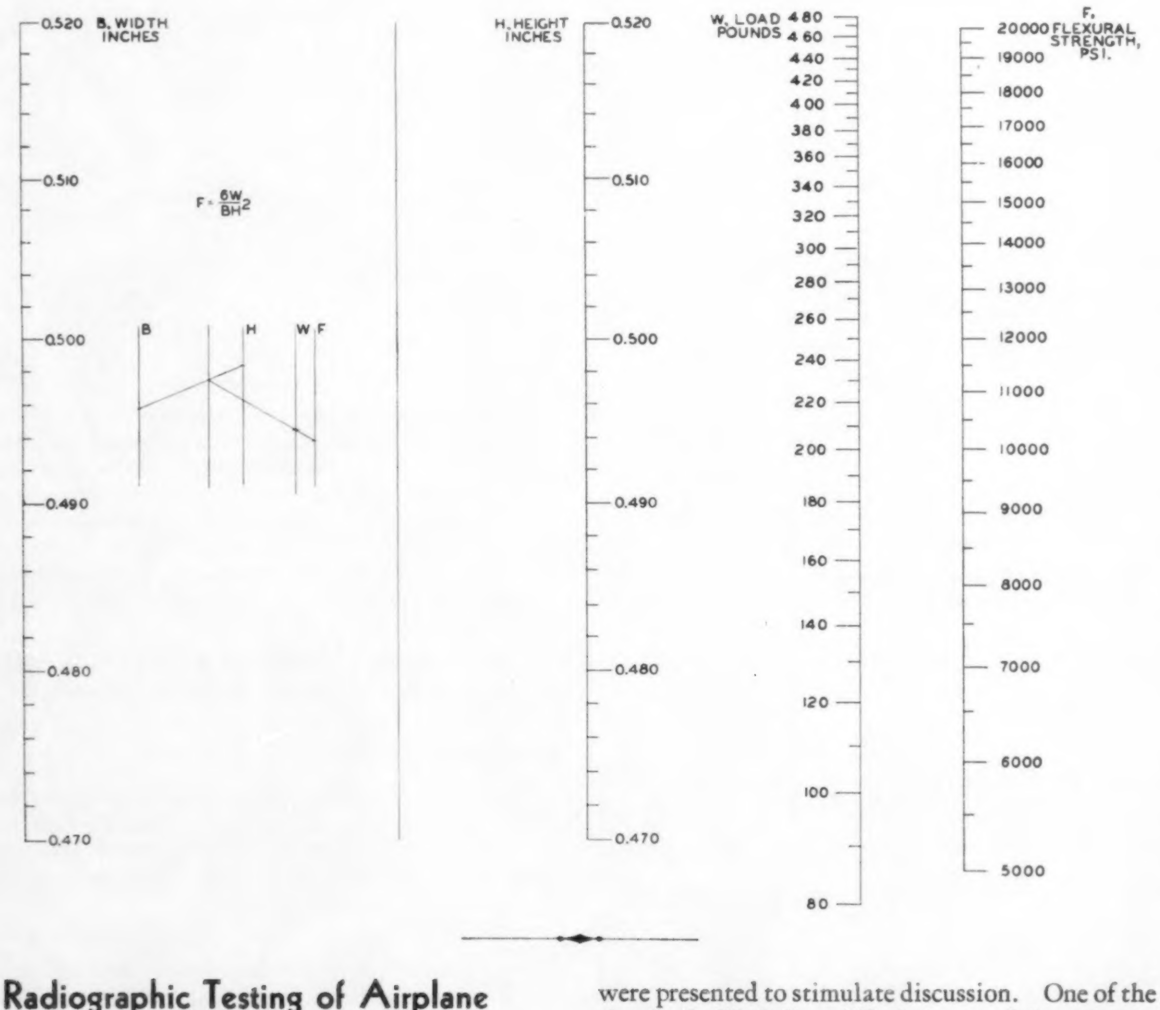
where F = flexural strength in pounds per square inch,
W = central load in pounds,
B = width of specimens in inches, and
H = height of specimens in inches.

It covers a range of B and H from 0.470 in. to 0.520 in. and flexural strengths from 5000 to 20,000 psi.

Note.—Anyone desiring full-size zincographs of the original may obtain them upon request to Mr. I. L. Hopkins at 463 West St., New York, N. Y.

Note.—Discussion of this paper is invited, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Member of Technical Staff, Bell Telephone Laboratories, Inc., New York, N. Y.



Radiographic Testing of Airplane Components

A topical discussion on radiographic testing of airplane components was held during the Annual Meeting in June, 1940, at which time three informal papers were presented to stimulate discussion. One of the papers, that by L. W. Ball on "Technique and Organization in the Radiography of Aircraft Castings," together with much of the oral discussion has now been made available in mimeograph form. Members of the Society may secure copies from Society Headquarters upon request.

Work of Technical Committee A on Automotive Rubber

A Résumé by E. G. Kimmich

EDITOR'S NOTE.—The following résumé of work of Technical Committee A of A.S.T.M. Committee D-11 on Rubber Products was presented at a recent Cleveland district meeting of the Society of Automotive Engineers by E. G. Kimmich, Development Engineer, The Goodyear Tire and Rubber Co., who is very active in the work of Committee D-11 and is chairman of its Subcommittee I on Mechanical Rubber Hose, and is also chairman of Subcommittee I on Classification of Rubber Motor Mountings of Technical Committee A on Automotive Rubber. This group, as Mr. Kimmich points out, is sponsored jointly by the S.A.E. and A.S.T.M. functioning under the auspices of Committee D-11. A very recent accomplishment of the technical committee as announced in the March ASTM BULLETIN is the completion of proposed new methods of test for automotive air brake hose and vacuum brake hose, which will be published by the A.S.T.M.; companion specification requirements are to be issued by S.A.E.

THE NEED FOR COOPERATION between the rubber and automotive industries on engineering properties of rubber and specifications for rubber resulted in the formation, in June, 1939, of an engineering group known as "Technical Committee A," under the joint sponsorship of the Society of Automotive Engineers and A.S.T.M. The membership in this committee was selected by the two societies and appears to be adequately representative of both industries. The automobile, aviation, truck and bus branches, the U. S. Government, and a number of the rubber companies are represented. In addition, many other companies who have not been designated as members have participated in the work.

The subject was, of course, of such broad nature that the committee found it necessary to define its field of operation, as follows:

1. To coordinate the work of A.S.T.M. with the needs of the automotive industry.
2. To demand new test procedures when necessary and more speed in establishing them. This committee will look to the other A.S.T.M. committees for methods of testing rather than to absorb their work.
3. To further the use of A.S.T.M. standards in the automotive industry.
4. To establish classifications of rubber compounds suitable for automotive uses and designate them by an S.A.E. numbering system. The classification will be by physical characteristics exclusively except where the service conditions expose the rubber to chemical action. No attempt will be made to establish properties of finished product by chemical analysis or by specifying ingredients.

After $1^1/_2$ yr. the committee has made good progress along all of the original designated avenues.

Possibly the item of greatest ultimate importance is the classification of rubber compounds. This strikes at a vital need. Engineers have not found it easy to specify what they want. The committee has ready for final consideration physical requirements for ten compounds suitable for motor mountings. This group comprises several degrees of hardness and various combinations of low compression set and high tensile strength, it having been determined that the lowest set and the highest strength do not necessarily coincide in the same compounds and there seems to be a need for both types. Undoubtedly this group of ten stocks will eventually be reduced to a much smaller number for this one purpose.

A proposal for naming the various compounds for differing uses has been worked out. For instance, one of the motor mounting stocks is to be known as M-1040; the M signifying that it is suitable for motor mountings, the numeral 10 referring to the type of compound, and the 40 a nominal designation of the stiffness. By various manipulations of a numbering system of this kind, we shall be able to designate compounds for all necessary purposes.

The second classification of compounds tackled by the committee is the axle bumper group. Because it was necessary to work out completely new testing procedures, the bumper classification is not ready, but considerable progress has been made.

In none of this work can we rely on chemical analysis or chemical makeup of the compounds. Chemical tests will be necessary where the compound is exposed to chemical action in service, but where the use of the rubber is largely physical it is absolutely necessary to depend on physical tests. The reason for this is not hard to comprehend when we realize that the behavior of a rubber compound is not dependent alone on its chemical constituents but very largely on the physical structure. It may not be a perfect analogy but I understand that whereas S.A.E. steels have been specified chemically in the past, the recent trend is toward the recognition that physical structure is of utmost importance. I refer to grain size and hardenability.

An example in rubber of the dependence on physical nature is seen in the difference in ultimate results of compounds including carbon of various kinds. Carbon black of the proper physical characteristics makes possible compounds of more than 4000 psi. tensile strength and of very high abrasion resistance. Reinforcement is associated with the very finely divided condition of the material. Similar additions of carbon in the form of finely powdered coal, instead of raising the tensile strength and the abrasion resistance, greatly reduce both of these properties. Many other examples can be cited of differing results from identical chemical constituents having different physical characteristics; also the rubber itself acquires differing physical properties due to processing variations that may not be accompanied by chemical changes.

Due to the joint nature of this committee's work, a division of the ownership of the results was made. Any changes in the methods of test are taken over and published by the A.S.T.M. Any standards that are established with respect to the numerical values required under these tests are published by S.A.E. The first completed instance of this procedure involved automotive hydraulic brake hose standards. It came to our attention that municipalities and state governmental agencies were requiring specifications on hydraulic brake hose. Our committee developed suitable specifications and methods. The methods were published in December as part of the new edition of the volume, "A.S.T.M. Standards on

Rubber Products," and the actual requirements on the hose are being included in the current 1941 edition of the S.A.E. Standards Handbook. The Handbook will refer to the A.S.T.M. methods but will not repeat them.

Incidentally, the book of "A.S.T.M. Standards on Rubber" has developed into a collection of very useful tests applicable to automotive rubber as well as rubber in general. This book is being published annually and has become the testing manual of the rubber industry.

The latest edition of the rubber standards includes, in addition to the hydraulic brake hose methods, the following changes sponsored by Technical Committee A:

1. Simplification of the testing fixture for compression-set Method A.
2. An improved method of using compression-set Method B.
3. An entirely new method of compression-deflection testing.

The last item (D 575 - 40 T) establishes a standard specimen for making compression tests and also provides for compression tests on finished articles of whatever shape. Every designer using rubber in compression soon runs into the fact that the shape of a rubber piece has a very large influence on the apparent stiffness. Utilizing these methods, the correct stiffness of a commercial shape can be determined by testing both the actual shape and a standard piece cut from it. Thereafter, the comparison can be made on commercial pieces without destroying them. The result of this is considered in these methods.

Technical Committee A has ready for final action methods and standards for vacuum brake hose and air brake hose which were started immediately after the successful conclusion of the hydraulic brake hose specification.

The committee has requested work in the appropriate A.S.T.M. subcommittees on

1. Hardness measurements
2. Tear test methods
3. Aging test methods
4. Flexometer test methods
5. Radiator hose test methods and standards

All except the last item were already being worked upon, but the interest expressed by the S.A.E. membership has greatly accelerated the progress in the various committees. The radiator hose program is an extensive one and is expected to take care of the problems encountered with the various new coolants and cooling systems.

In the matter of hardness, we seem to be approaching the time when we shall no longer be annoyed by the vagaries of certain types of hardness testers. The committee handling this is making splendid progress toward standardization of measurements.

All through this work there has been excellent cooperation by the various companies and we have had the benefit of much mutual research work. However, there is a large field which can be properly handled only by a large organized cooperative research effort. Technical Committee A has been working toward such an end but present conditions seem to make immediate progress along this line very doubtful. We do hope, however, that eventually this will be carried to accomplishment.

Service Experiences with the Newer Condenser Tube Alloys

Abstract of Report of the A.S.M.E. Special Research Committee on Condenser Tubes

The report, "Service Experiences with the Newer Condenser Tube Alloys," was presented by the A.S.M.E. Special Research Committee on Condenser Tubes at the annual meeting of the A.S.M.E., December 3, 1940. The material for the report was obtained in response to a questionnaire distributed to 162 organizations throughout the United States representing the largest operators of land and marine surface condensers and the several condenser tube manufacturers.

It was prepared to cover the experiences with the newer condenser tube alloys such as aluminum brass, aluminum bronze, copper nickel, copper nickel tin, and copper nickel zinc of which a large tonnage has been installed in the past ten years.

The stations on uncontaminated inland rivers and lakes reported continued success with the older alloys of admiralty, Muntz and arsenical copper alloys. The adoption of the more expensive alloys probably cannot be justified in stations where the older alloys are giving from 70,000 to 120,000 service hours with few failures.

Where service is severe, adoption of the newer alloys is taking place quite generally. The reports of companies using salt or brackish circulating waters in their condensers were all in favor of the newer condenser tube alloys.

The newer aluminum or nickel bearing alloys resist dezincification and are most effective in eliminating failures from this source. The aluminum bearing alloys resist impingement attack better than the older type alloys.

In many stations where the older alloys have not given satisfactory service, trial installations were made to select the alloy best suited to the particular conditions. The trial installations usually consisted of batches of the newer alloy tubes installed in one or more of the condensers.

A company operating condensers with harbor circulating water carrying coke and ash particles that lodged in the tubes, and excessive amounts of entrained air that caused severe inlet end impingement attack found that alloys containing aluminum have a much longer life than nickel alloy or admiralty metal tubes. This is due to the fact that dezincification does not occur and that inlet end corrosion resulting from impingement attack is greatly decreased.

Another seaboard company found that an experimental installation of aluminum brass tubes outlasted two sets of admiralty tubes and as a result equipped two condensers with aluminum brass tubes which to date have given very satisfactory service.

Short-time tests, designed to permit a fairly quick determination of the relative values of the various alloys, have been undertaken by a number of companies.

One company made a test of 39 tubes representing 12 different alloys. Short lengths of the tubes were placed in a rack, which in turn was placed in the inlet water box of one of the main unit condensers, about 8 in. in front of the tube sheet so that the samples were directly in the flow of the circulating water and subjected to its full turbulence. Each sample was accurately weighed at the start of the test and also at 6-month intervals thereafter. This weight when compared with the original weight gave the percentage loss in weight for the sample.

A wide variation in the performance of the tubes was noted. A study of the data indicated a distinct grouping of the tubes according to their chemical compositions. The first group (lowest percentage loss in weight) includes only those tubes containing aluminum; the second group the cupro-nickel tubes; and the third the admiralty and miscellaneous alloys. The divisions between the groups are marked and indicate that this grouping is no accidental occurrence.

A study of the aluminum brass samples indicated that the annealed tubes are superior to the hard-drawn tubes and, further, that the optimum aluminum content is close to 2.5 per cent. This was noted in contrast to the present-day tendency of American manufacturers to keep the aluminum content at or under 2 per cent. The conclusions are based on the tests reported above and not on service experience.

Stations operating under conditions peculiar to their particular locations have experimented to determine the alloy best suited to their individual problems. An example of this is the investigation made by a public utility company with a station on an inland river contaminated with acid drainage water from nearby mines. This investigation led to the conclusion that at this station metals that resist salt water and alkaline water do not resist acid mine water. In a test under actual service conditions an alloy of 88 per cent copper, 10 per cent zinc, 2 per cent tin showed up best of eight alloys tested—better than 70/30 copper-nickel; admiralty; aluminum brass; aluminum bronze; arsenical copper; 70 per cent copper, 29 per cent nickel, 1 per cent tin; and 70.5 per cent copper, 26 per cent zinc, 2 per cent aluminum, 1.5 per cent nickel.

A second test was made by suspending plates of 20 alloys and nickel in the water box of a condenser. It was established from this test that alloys containing a high percentage of chromium are the only ones that completely resist the acid-water corrosion. Alloys containing nickel were poor and pure nickel extremely poor.

The tests are being continued with condenser tubes of seven different alloys:

18 per cent chromium, 8 per cent nickel, 74 per cent iron (stainless steel)
18 per cent chromium, 82 per cent iron (stainless iron or chrome iron)
88 per cent copper, 8 per cent zinc, 4 per cent tin
99.92 per cent copper, 0.025 per cent phosphorus—plus some silver
98.9 per cent copper, 0.27 per cent zinc, 0.45 per cent chromium
Red brass (85 per cent copper, 15 per cent zinc)
Phosphorized admiralty

The Navy Department, Bureau of Ships, has, under actual service test aboard ship, condenser installations containing tubes made of the following different alloys aside from the standard installations of admiralty and 70/30 copper-nickel alloy:

Copper-nickel-tin
Aluminum-copper-nickel
Copper-nickel-zinc
Nickel-copper (monel)
Dorium "D" metal
Copper-nickel (hard drawn)

The Bureau of Ships continues to specify the use of 70/30 copper-nickel tubes and tube sheets in the construction of all heat exchangers including condensers employing salt water as the cooling medium. From a comparison with other alloys under actual service conditions 70/30 copper-nickel tubing has demonstrated high corrosive-resistant qualities. With the zinc content of this alloy kept within the limit of one-half of one per cent, the failure of condenser tubes from dezincification is practically eliminated. It has been definitely established that admiralty metal tubes are capable of withstanding direct impingement action of either steam or salt water better than 70/30 copper-nickel tubes although admiralty tubes are subject to failure as the result of dezincification.

To date the performance of 70/30 copper-nickel tubes has been most satisfactory and none of the above-mentioned alloys has proved superior to 70/30 copper-nickel. The condenser installations in which the above tubes are provided vary from 100 sq. ft. to 10,000 sq. ft. in condensing surface. The length of service during which the above-mentioned tubes have been under test varies from 12 months to 6 yr. The area of greatest failures has been either at the top of the tube bank or in the path of the incoming circulating water. In the case of admiralty tubes, most failures have been attributed to local pitting and plug type dezincification; layer type of dezincification usually occurs in tubes that have been in service for many years. In the case of 70/30 copper-nickel tubes, most failures have been attributed to erosion at the inlet ends, steam impingement wearing down the tube wall from the steam side and to localized pitting usually resulting from the presence of a foreign particle.

In order to combat the effects of inlet end impingement attack and still retain the high corrosive-resistant qualities of 70/30 copper-nickel, the Bureau of Ships has developed an ideal plastic condenser tube end protector fabricated from Bakelite, Neoprene, and combinations of Bakelite and Neoprene. It was found that the inserts have a long service life and ideally protect the inlet ends of the tubes.

In conclusion it may be stated that:

1. Where harbor water, or river water contaminated with sea water, is used for condensing purposes, aluminum brass condenser tubes are being used in increasing amounts, particularly where relatively high velocities through the tubes are used and turbulent water conditions are present in the inlet water boxes.

2. Copper-nickel 70/30 has come to be recognized as showing the best all-around corrosion resistance to salt water aboard naval and other vessels, it having become practically standard for condenser use by the U. S. Navy. However, it does not appear to be the most satisfactory alloy for use in power stations located at tide water and, in particular, using contaminated harbor waters.

3. Admiralty and arsenical copper are continuing to give excellent service in condensers using fresh water.

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Standard Specifications for Materials

A Statement by Lyman J. Briggs, Director, National Bureau of Standards

Our country needs now, more than ever before, good specifications for materials. By a good specification I mean one (*a*) that is limited to the essential characteristics of the material; (*b*) that defines the requirements for these essential characteristics in quantitative terms; and (*c*) that specifies the testing methods to be employed in every case where any question might arise. Only in this way can a complete understanding be reached between buyer and seller. A good specification promotes trade, eliminates argument, and speeds the transaction.

The Federal Government must buy its materials on the basis of specifications. This provides for open competition and eliminates charges of favoritism. Good specifications are necessary to make this procedure successful. But these specifications provide simply the framework for the transaction. Only adequate tests can determine whether the requirements of the specification have actually been met.

The American Society for Testing Materials, as a basis for its work on specifications, has taken an outstanding part in the development of adequate methods for testing materials, but much remains to be done. Specifications and test methods must not be looked upon as static in character. They must keep abreast of the improvements and changes made in materials. Test methods must be simplified whenever possible to expedite and reduce the cost of tests.

Plastics are finding an ever-widening use in the defense program. Good specifications and test methods are urgently needed now. The A.S.T.M. has the direct responsibility of making these available at the earliest possible moment.

A needless multiplicity of varieties of steel and nonferrous alloys has developed under the influence of a buyers' market during recent years. A drastic reduction in the number of these alloys is now necessary to promote quantity production. This is a vitally urgent matter.

The necessity of finding substitutes for certain critical and strategic materials that are limited in quantity imposes an additional burden on those charged with the preparation of specifications. Any necessary lowering of the requirements of existing specifications should be recognized as temporary and as applying only during the emergency. We must not relinquish hard-fought gains.

President Barr Writes:

As the date for the annual meeting approaches, our attention is drawn to the general condition of the Society. It is of keen interest that the membership has now passed the previous high, with 4442 members (not including over 400 student members). Of this number 136 are sustaining members, which assures the interested support of many leading industries in a substantial form. The sale of publications has reached an all-time high. This is further indication of the increasing usefulness of the organization and the value of A.S.T.M. specifications.

Many departments of the Federal Government have long been well represented in the committee work and other activities and it is gratifying to know that our organization has recently been called upon to take an active part in the National Defense program by having our Secretary-Treasurer spend some time in Washington assisting the Office of Production Management in the work of conservation of scarce materials. This further recognition of the direct application of the information and experience accumulated during many years is the best evidence of the success of the plan on which the A.S.T.M. was founded.

The sustained and growing interest in the work of the Society was manifested by the large attendance and the excellent program at the Spring Meeting in Washington during the first week of March. The work of the District Committees from coast to coast has been exceptionally fine throughout the year.

All this activity has been carried out during a period when the membership was occupied with individual business interests in ever-increasing volume. The officers of the Society wish to express to all our members, and to the firms they represent, sincere appreciation for the time they have given to the work.

The Forty-fourth Annual Meeting in Chicago is expected to be one of great interest and value and a large attendance is expected. It is our earnest hope that the work of A.S.T.M. may contribute not only to the National Defense but to the pursuits of peace for the protection of which the defense program is building.

Sincerely,

Wm Barr

President

"Stock Piles"

Probably never before has there been such a need for the mobilization of all of our materials as at the present time. Of some of our materials not an adequate supply is available; some few may not be available at all for industrial uses. This will require either the development of new materials or more probably the adaptation of old or familiar materials to new uses. Already there has been much talk of changes in specifications or the shifting to an entirely different material—in other words, the substitution of another specification. Some of the changes have in mind either the conservation of certain elements

or materials or may be dictated by the exigencies of supply and production which require the recognition of higher maximums of impurities that would not otherwise be permitted.

All of this will require the mustering of all our resources of knowledge of the properties of materials. Can the changes suggested be made safely or is adequate knowledge available concerning the utility of the materials to which it is proposed to shift? The experience of materials engineers will be called upon as never before to answer questions such as these and recourse will need to be had to all of our storehouses of knowledge. Every technical library will be working overtime to supply desired information. It is under conditions such as these that the data developed by our standing committees and in the reports on researches that are presented by individual authors will stand us in good stead and will make the technical publications invaluable. H. W. Gillett in *Metals and Alloys* refers to the need for "stock piles of knowledge" and one of the important functions of the Society will be the accumulation and distribution of these "stock piles."

Youth and Age at the Annual Meeting

In one of his usually trenchant articles in *Metals and Alloys*, Dr. H. W. Gillette, discusses "Youth and Age," and after commenting on the importance of looking at things broadly and the fact that this ability is transmittable by example to a large number of colleagues, he writes, "It is not hard to recognize the people who do look at things broadly. When a youngster has an opportunity to confer with, or to do committee work with individuals of that type, he should seize it, as a means to a very important part of his education."

Along related lines, John R. Townsend, Bell Telephone Laboratories, Inc., discussed in the October, 1939, ASTM Bulletin the advantages of A.S.T.M. membership to junior engineers and the invaluable experience which the younger man can absorb, involving what might be called human engineering. Participation in A.S.T.M. work, he writes, can be likened to a bridge passing from scholastic work and early industrial experience to real practice. He further urged that where a company or a sustaining membership can permit several members of its technical staff to attend Society meetings this A.S.T.M. school of training be definitely considered.

We submit that an annual meeting of A.S.T.M. is an excellent place for the junior engineer and younger technical executive concerned with materials, the research chemist and analyst, the technologist concerned with quality control and production to absorb and participate in technical activities which should be of definite benefit.

Needless to say, a very cordial invitation is extended to all such to be present. Furthermore, the senior members of the Society and the senior company representatives are urged to try to bring to Chicago from June 23 to 27, some of their younger associates. The technical sessions will be well worth while and an interesting Apparatus Exhibit is in prospect. Not the least of the annual meeting values is the personal contact with technical men of influential standing.

Apparatus and the Annual Meeting

Beginning with the annual meeting ten years ago, the Exhibit of Testing Apparatus and Related Equipment has been an important feature of meetings in alternate years. Initiated, frankly, as an experimental adjunct although recognizing at the start its potentialities for keeping the testing fraternity informed of important developments in the field, the Exhibit is now recognized as being part and parcel of the annual meeting, serving the same purpose as technical discussions, conferences, etc. It takes its place with other features of the meeting—the reports and papers, informal gatherings—and provides additional opportunities to mingle with one's colleagues. It is a worth-while incentive to take one to the annual meeting.

An important function of the Exhibit is to serve as a meeting ground for the supplier and the purchaser to discuss mutual problems; to provide the instrument maker with an opportunity to meet men from all fields who can advise him on the various obstacles an instrument must overcome. He in turn can advise the user why certain refinements may not be essential, and why, in the interest of production or cost saving, modifications may be desirable.

One of the primary purposes of the Society is the promotion of knowledge and the testing of materials. No standard test procedures can be established without having suitable apparatus available. This year, despite serious materials problems, many leading apparatus and laboratory supply manufacturers and distributors are participating wholeheartedly, and will, as formerly, help to stress the educational aspects of the Exhibit.

No one should fail to spend considerable time in the Exhibit taking advantage of the various displays that will be made available.

Secretary-Treasurer on Assignment to O.P.M.

At the request of Mr. Donald M. Nelson, Director of Purchases, Office of Production Management, the Executive Committee has arranged for the Secretary-Treasurer of the Society to devote part of his time to the work of the O.P.M. in the conservation of scarce materials in the interests of the National Defense Program. Mr. Warwick will serve as a Consultant on Specifications for Strategic Materials, in the Division of Purchases, O.P.M., and will work closely with the recently organized Conservation Section of O.P.M. His work will have to do particularly with the conservation of materials in relation to purchases by the various Governmental agencies, in which emergency revisions of Federal specifications will be an important factor.

Having previously offered its services to the Government in furtherance of the Defense Program through its research and standardization activities, the Society through the Secretary's new relationship will be in a position to render this help promptly and effectively. The value of A.S.T.M. specifications to industry and Government in the present emergency is recognized, and many opportunities for effective contributions by the

A.S.T.M. to the whole problem of specifications for and procurement of defense materials will be found.

Mr. Warwick began his duties with O.P.M. on April 23 and for several weeks expects to devote full time to the work because of its urgency and the need for developing a suitable staff to carry on these particular aspects of conservation of materials. Thereafter he will serve on a part time basis. During his absence in Washington, the Assistant Secretary of the Society, R. E. Hess, is in charge of affairs at Society Headquarters.

Nominations for Officers

The Nominating Committee to select nominees for Society officers met in Washington on March 7. The personnel of this group was listed in the March Bulletin. In accordance with the provisions of the By-laws of the Society, the following nominations are announced.

For President:

G. E. F. Lundell, Chief, Chemistry Division, National Bureau of Standards, Washington, D. C.

For Vice-President:

Dean Harvey, Materials Engineer, Engineering Laboratories and Standards Dept., Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

For Members of Executive Committee:

A. W. Carpenter, Manager of Testing Laboratories, The B. F. Goodrich Co., Akron, Ohio

T. A. Fitch, Director, Bureau of Standards, City of Los Angeles, Calif.

C. D. Hocker, Plant Products Engineer, Bell Telephone Laboratories, New York City

J. L. Miner, Director and Vice-President, Atlas Lumnite Cement Co., New York City

E. W. Upham, Chief Metallurgist, Chrysler Corp., Detroit, Mich.

Each of the above nominees has indicated in writing his acceptance of his nomination. The By-laws provide that "further nominations, signed by at least 25 members, may be submitted to the Secretary-Treasurer in writing by May 25, and a nomination so made, if accepted by the member nominated, shall be placed on the official ballot" which "shall be issued to the members between May 25 and June 1."

Proposed Revisions of By-laws

At its meeting held on April 15, the Executive Committee voted to recommend to the Society at the Annual Meeting that Article III, Section 2 of the By-laws regarding time of appointment of the Nominating Committee be amended to provide that the committee be named at the October meeting of the Executive Committee instead of at the January meeting, with a corresponding advance in the date for the receipt of nominations. This earlier appointment will permit the personnel of the Nominating Committee to be announced in the Bulletin before the committee meets to select nominees. The detailed changes recommended will appear in the annual report of the Executive Committee.

Sustaining Members Now Total 136

Since the publication of our March Bulletin, three new sustaining members have been added to the ever-increasing list of companies which support the work of the Society by this type of membership. Brief accounts of the A.S.T.M. activities of these companies are given below. It will be noted that like most of the companies which have been listed previously as they acquired sustaining membership, these three organizations have contributed much in forwarding the standardization and research programs of A.S.T.M.

This embracing of sustaining membership by the country's leading industrial organizations is of great significance to the Society, for by strengthening and enlarging the financial support of its work, a twofold benefit is created. The Society can expand and accelerate many of its projects to a greater degree of productiveness on the one hand, while industry can convert this knowledge into practical advantages on the other hand.

Announcements of some of the benefits involved in a Sustaining Membership such as the receipt of a copy of *every* publication issued by the Society have been made from time to time in these Bulletins.

The dues for a sustaining membership are $100 yearly while other corporate or company members pay $30. Individual membership dues, which include Government departments, universities, libraries, and the like, are $15.

Southwestern Portland Cement Co., George E. Warren, Vice-President and Manager, Osborn, Ohio.

For over 20 years Mr. Warren, having been a personal member from 1920 when he was with the Portland Cement Association until he became the representative in 1930 of the membership held by Southwestern, has been active in various phases of A.S.T.M. work. Affiliation of his company dates from 1926. Mr. Warren represents his company on Committees C-1 on Cement and C-6 on Drain Tile. He renders prominent service to the Society in his capacity as Chairman of the Subcommittee on Cement Reference Laboratory whose projects are sponsored jointly at the National Bureau of Standards by Committee C-1 and the Bureau. R. M. Wilson, Chief Chemist, who for over ten years represented the company membership maintained by this organization at Victorville, Calif., has with the acquiring of sustaining membership become a personal member of the Society.

Westinghouse Electric and Manufacturing Co., Dean Harvey, Materials Engineer, Engineering Laboratories and Standards Dept., East Pittsburgh, Pa.

One of the early members of the Society, this organization through its large number of technical executives and engineers who are participating in a great many phases of A.S.T.M. work has during the life of the Society contributed a great deal to the advancement of all phases of work. With more than 15 of the company's engineers affiliated with the Society personally and a larger number active in committee work, it is impossible in any condensed article of this type adequately to give complete details of all the activities in which the company is concerned. Mr. Harvey, who has just been nominated for the office of Vice-President served a term as a member of the Executive Committee from 1938 to 1940, and N. L. Mochel, Manager, Metallurgical Engineering, who has been a personal member since 1920, was a member of the Executive Committee from 1935 to 1937. In addition to other activities Mr. Mochel is Chairman of Committee A-1 on Steel and of the Joint Research Committee on Effect of Temperature on the Properties of Metals. Mr. Harvey is the Chairman of Committee B-4 on Electrical-Heating, Resistance, and Furnace Alloys, while Thomas Spooner, Manager, Central Engineering Laboratories and Standards Dept., in East Pittsburgh, a personal member since 1919, is Chairman of Committee A-6 on Magnetic Properties.

Other personal members of Westinghouse who are very active in A.S.T.M. work include P. H. Brace, Engineer, Research Dept., at Wilkinsburg, Pa., since 1919; P. G. McVetty, Mechanical Engineer, Research Laboratories, East Pittsburgh, since 1928; R. E. Peterson, Manager, Mechanics Division, Research Laboratories, since 1929; and A. Nadai, Consulting Engineer, Research Laboratories, since 1934. Mr. C. E. Skinner, now retired by the company, has a personal membership which antedates by one year that of the company, 1903.

In addition to the committees previously indicated, the company is actively represented on such groups as Committees D-9 on Electrical Insulating Materials, A-10 on Iron-Chromium-Nickel and Related Alloys, D-13 on Textile Materials on which Mr. Harvey has been very active, D-2 on Petroleum Products and Lubricants, and the committees on spectrographic analysis and chemical analysis of metals. Mr. Mochel is a member of Committee E-10 on Standards, one of the important administrative committees. Among the numerous other activities of the company's personnel have been Mr. Harvey's former chairmanship of the Pittsburgh District Committee and Mr. Mochel's service as former chairman of the Philadelphia District Committee. Many of the Society's *Proceedings* and technical publications have been enhanced by papers and reports prepared by Westinghouse engineers.

Scovill Manufacturing Co., William B. Price, Chief Chemist and Metallurgist, Waterbury, Conn.

Although the company affiliation of this organization with A.S.T.M. dates from 1928, Mr. Price has been connected with the Society since 1913 and has been extremely active in A.S.T.M. technical work, particularly in the field of non-ferrous metals. For many years he has been a member of Committees B-3 on Corrosion of Non-Ferrous Metals and Alloys, E-2 on Spectrographic Analysis, and E-4 on Metallography, and his work on Committees B-2 on Non-Ferrous Metals and Alloys and B-5 on Copper and Copper Alloys, Cast and Wrought has been particularly notable. He is a member of several subcommittees of Committee B-2 and often of the B-5 subgroups. He is also the representative of his company on the new Committee B-8 on Electrodeposited Metallic Coatings. F. M. Barry, Chemist, who has been a personal member of the Society since 1925, serves on three standing committees, being particularly active in the work of Committee E-3 on Chemical Analysis of Metals. M. A. Williamson, Metallurgist, has recently become a Junior Member of the Society.

Detroit Meeting Featured by Papers on Changes in Materials Due to Defense Requirements

The Detroit District Committee arranged a very successful dinner meeting on Friday, April 18, at the Hotel Statler featuring four talks by outstanding authorities on the general subject "Changes in Materials Due to Defense Requirements." Some 200 men attended the dinner and there were over 350 present at the technical session which followed. Those in charge of the meeting for the Detroit district handled the various activities in their usual efficient manner. J. L. McCloud, Metallurgical Chemist, Ford Motor Co., chairman, arranged for the speakers, and C. H. Fellows, Head, Chemical Division, Research Dept., The Detroit Edison Co., vice-chairman, was in charge of the dinner, with W. P. Putnam, President, and Technical Director, The Detroit Testing Laboratory, responsible for ticket sales and related matters. Publicity and promotional matters were excellently handled by W. C. Du Comb, President, W. C. Du Comb Co., Inc., and Martin Castricum, Manager, Textile Section, Product Development Division, United States Rubber Co., secretary of the District Committee.

Mr. McCloud presided during the technical session introducing the speakers. R. J. Painter, Assistant to the Secretary, A.S.T.M., discussed Society activities indicating the continued intensification in the fields of both standardization and research, and also spoke of the added responsibility of A.S.T.M. during this critical period in our national life. The speakers and the subjects they discussed were as follows:

Non-ferrous Metals—J. S. Laird, Ford Motor Co.
Chemicals and Plastics—J. K. Hunt, E. I. du Pont de Nemours and Co., Inc.
Rubber—S. M. Cadwell, United States Rubber Co.
Ferrous Metals—E. C. Smith, Republic Steel Corp.

Each of these men, an outstanding authority in his field, presented trenchant and very interesting discussions adhering closely to the general subject "Changes in Materials Due to Defense Requirements," Messrs. Laird and Hunt pointed their remarks particularly to the automotive industry. Doctor Laird gave some indication of the needs of the industry with respect to nickel and zinc, and to other non-ferrous metals, discussing in particular plating problems and die castings. He mentioned some of the intricate castings needed and the desirability of proper casting metals. In his opening remarks, he paraphrased the statement of a certain European personality that we were probably in for a stage of not necessarily "guns instead of butter," but "guns instead of glitter," particularly with respect to automobiles.

Of the four speakers, Doctor Hunt gave probably the most optimistic outlook, if "optimistic" is the proper word. Another speaker complimented the chemical industry on its great development in recent years of many important materials. It was pointed out that in the early 1920's the number of strategic materials totaled some 40, whereas now the figure is down to less than 15.

Attention was focused by Doctor Cadwell on the various rubber-like materials which can replace rubber in some cases much more satisfactorily than the natural material, and gave some indication of the quantities becoming available. He also mentioned domestic or other readily available sources of rubber.

There was intense interest in Mr. Smith's very informative remarks on the subject of "Ferrous Metals," particularly, of course, in relation to steel. He spoke of the extreme desirability of a 90 or 91 million ton production this year, its possibilities, and the serious effect thereon of a soft-coal strike and related factors. Also, he cited the importance to the industry of an adequate supply of certain metals such as aluminum, nickel, molybdenum, and the like, giving examples of replacement of certain metals,

Detroit District Committee Officers: C. H. Fellows, J. L. McCloud, and Martin Castricum.

which, however, involved difficult problems. Based on perhaps not so much our current needs, but what the next year and the following year may have in prospect, one could conclude from his authoritative remarks that production certainly must keep stepping.

A general conclusion of the four papers is not possible, but there is room in certain fields for some optimism and certainly plenty of room in considering some of the metals for a "lack of optimism," to put it mildly. Anyone going from the meeting certainly should have taken with him a realization that intensive work on the part of American industry and the necessity of close cooperation of all interests, including the Government, is essential.

All phases of the meeting went off smoothly—the dinner ended promptly at the scheduled time; the technical session was not dragged out; the speakers handled their subjects splendidly. It can truthfully be said that this meeting was among the finest technical get-togethers yet sponsored by a Society group.

Replacement Materials Discussed at April Philadelphia District Meeting

A very interesting open conference on replacement materials was held at the Franklin Institute on Tuesday evening, April 29, under the auspices of the Philadelphia District Committee, with more than 350 members, guests, and visitors present and a number of prominent technical authorities participating in the informal discussion.

Mr. F. G. Tatnall, Baldwin-Southwark Division, Baldwin Locomotive Works, who is Chairman of the District Committee, presided as co-chairman with Mr. Judson F. Vogdes, Materials Engineer, who had developed the program.

Mr. Donald Clark, Chief, Equipment and Supplies Branch, Purchasing Division of the Office of Production Management, came especially from Washington to attend the meeting accompanied by C. L. Warwick, Secretary-Treasurer. Dr. Gilbert E. Seil, Chairman of the Ferrous Minerals and Ferroalloys Groups of the National Research Council Advisory Group, was also present.

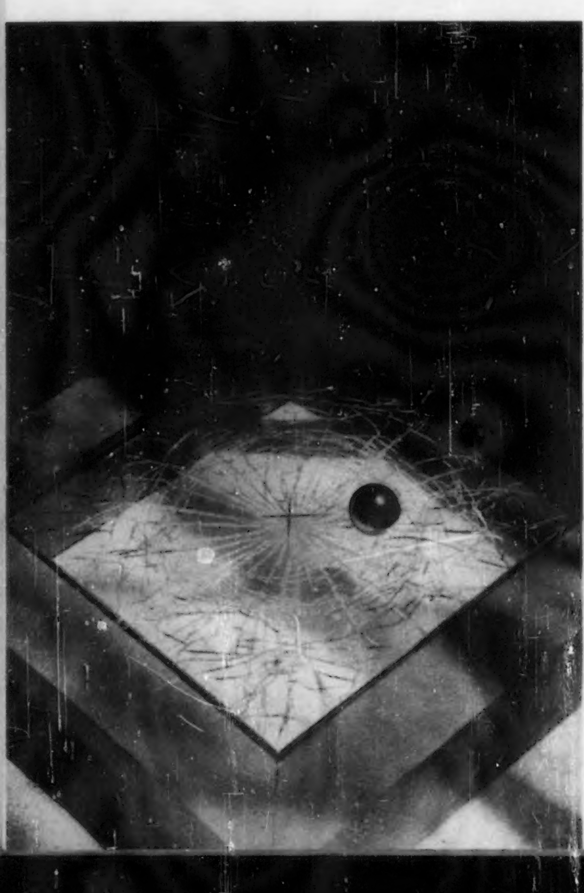
Mr. Clark outlined the O.P.M. setup and discussed in particular the problems of the Purchasing Division. He spoke of the cooperation which is evident in various service branches of the Government in connection with some of the important present problems of materials supply and urged the full cooperation of all those present in achieving the production that is necessary.

Mr. Warwick stated that the Society's Executive Committee was considering the most appropriate way of handling changes in standards because of supply problems. He pointed to the system being developed by the Federal Specifications Board setting up what are termed Emergency Alternate Standards. This term connotes the exact status of the changes. There is a definite feeling that a formal standard of the Society should not be modified on a temporary basis but that some form of issuing the changes for the present emergency be established. He also mentioned the Society can at any time issue proposed standards and new tentative standards and can approve desirable revisions of existing specifications and tests through the Committee on Standards procedure, which can act in the course of a very few days.

Dr. Seil spoke particularly of the manganese situation which he indicated is not too alarming. He mentioned the various deposits of ore which can be worked if necessary. Later he commented on the chromium supply, and here again the situation is not extremely pressing. Dr. C. H. Herty, Jr., of the Bethlehem Steel Co., pointed to one method of conserving manganese by making chemistry changes in some of the specifications for structural steel rails and related products. Such savings with reasonable discretion might amount to 10 per cent of the normal amount used.

Norman L. Mochel of Westinghouse Electric and Manufacturing Co. in discussing phases of the subject mentioned that products which involved the use of scarce or strategic materials might be classified broadly in three groups: *First*, where substitute materials can be used which do not affect at all or at least very immaterially the serviceability and utility of the product; *second*, those in which the use of substitute materials might cut down materially the service life. He used as an example a piece of clothing which if made with normal materials might last ten or fifteen years, but with the replacement materials used the customer would have to realize that a much less service life would have to be expected. In the third group no substitutes could be made and the consumer, if the necessary materials cannot be obtained, would simply have to forego having his products.

Quite a number of members and guests came some distance for the meeting, several from New York. From a news note in this Bulletin it will be noted that the committee is planning to have a continuation of the meeting on the evening of May 28 at the Franklin Institute.



"Unpierced—16-ft. Drop." An A.S.A. Test on Safety Glass

Awarded honorable mention, amateur class, in the Third A.S.T.M. Photographic Exhibit; submitted by Floyd Borgstedt, Patzig Testing Labs.

44th A.S.T.M. Annual Meeting and 6th Apparatus Exhibit, June 23 to 27, The Palmer House, Chicago

Philadelphia Meeting on Replacement Materials May 28

AT THE FRANKLIN INSTITUTE at 8 p.m. on Wednesday, May 28, the Philadelphia District Committee of the Society is sponsoring its second meeting on this general subject of replacement materials. While this is in a sense a continuation of the meeting held on April 29, briefly described in this BULLETIN, it will be of a more formal nature. The O.P.M. Advisory Committee on Metals and Minerals, of the National Academy of Sciences and National Research Council, which includes four important committees listed elsewhere in this BULLETIN, will have a number of its officers and men present to cover various materials in which it has been especially concerned. Dr. Clyde Williams, Chairman of the Advisory Committee has arranged for Dr. Zay Jeffries and Dr. Gilbert E. Seil to be present, and there will undoubtedly be a number of others of the committee in attendance. L. E. Ekholm, Metallurgical Engineer, Alan Wood Steel Co., is the chairman in charge of the technical program for the District Committee and other members of the committee will handle promotional and related matters.

Committee to Advise O.P.M. on Metals and Minerals

THE OFFICE OF Production Management has announced the formation of a committee appointed by the National Academy of Sciences and the National Research Council to advise the Office of Production Management on technical matters relating to metals and minerals. This committee is known as the Advisory Committee on Metals and Minerals. It is made up of the following four groups:

Ferrous Minerals and Ferroalloys Group
Metals Conservation and Substitution Group
Tin Smelting and Reclamation Group
Nonmetallic Minerals Group

This large committee will take over the activities of the various separate technical committees that heretofore have been advising the National Defense Advisory Commission and the Office of Production Management. Clyde Williams, Director, Battelle Memorial Institute, Columbus, Ohio, is chairman of the committee; Gilbert E. Seil, Technical Director, E. J. Lavino Co., Norristown, Pa., is chairman of the Ferrous Minerals and Ferroalloys Group; Zay Jeffries, Technical Director, Incandescent Lamp Dept., General Electric Co., Cleveland, Ohio, is chairman of the Metals Conservation and Substitution Group; and F. W. Willard, President, Nassau Smelting and Refining Co., Inc., New York, N. Y., is chairman of the Tin Smelting and Reclamation Group. The Nonmetallic Mineral Group is in process of formation.

It is expected that this enlarged committee will make investigations for the Office of Production Management of the technological aspects of the various metals and minerals important to national defense, and will act in a technical advisory capacity to the various executives and consultants in the Metals and Minerals Section, Production Division, Office of Production Management.

The membership of the Advisory Committee on Metals and Minerals is as follows:

Chairman, Clyde Williams, Director, Battelle Memorial Institute, Columbus, Ohio

FERROUS MINERALS AND FERROALLOYS GROUP

G. E. Seil, *Chairman*, Technical Director, E. J. Lavino Co., P. O. Box 29, Norristown, Pa.
A. C. Fieldner, *Secretary*, Chief, Technologic Branch, U. S. Bureau of Mines, Washington, D. C.
Ralph Bowman, Republic Steel Co., Cleveland, Ohio.
F. G. Cottrell, 3904 Ingomar St., N. W., Washington, D. C.
James Critchett, Vice-President, Union Carbide and Carbon Research Laboratories, 30 E. 42nd St., New York, N. Y.
J. V. N. Dorr, President, The Dorr Co., 570 Lexington Ave., New York, N. Y.
C. H. Herty, Jr., Research and Development Dept., Bethlehem Steel Co., Bethlehem, Pa.
D. F. Hewett, Principal Geologist, U. S. Geological Survey, Washington, D. C.
John Johnston, Director of Research, U. S. Steel Corp., Kearny, N. J.
Enoch Perkins, Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y.

METALS CONSERVATION AND SUBSTITUTION GROUP

Zay Jeffries, *Chairman*, Technical Director, Incandescent Lamp Dept., General Electric Co., Nela Park, Cleveland, Ohio.
W. H. Eisenman, *Secretary*, American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio.
R. S. Archer, Chief Metallurgist, Chicago Dist., Republic Steel Corp., Chicago, Ill.
E. W. Bennett, Vice-President, Dow Chemical Co., Midland, Mich.
A. L. Boegehold, Head, Met. Dept., General Motors Research Corp., General Motors Bldg., Detroit, Mich.
S. K. Colby, Vice-President, Aluminum Company of America, Gulf Building, Pittsburgh, Pa.
H. W. Gillett, Battelle Memorial Institute, 505 King Ave., Columbus, Ohio.
W. C. Hamilton, Research Director, American Steel Foundries, Indiana Harbor, East Chicago, Ind.
C. H. Herty, Jr., Research and Development Dept., Bethlehem Steel Co., Bethlehem, Pa.
John Johnston, Director of Research, U. S. Steel Corp., Kearny, N. J.
H. S. Rawdon, National Bureau of Standards, Washington, D. C.
A. B. Kinzel, Chief Metallurgist, Union Carbide and Carbon Research Laboratories, 30 E. 42nd St., New York, N. Y.
R. F. Mehl, Carnegie Institute of Technology, Pittsburgh, Pa.
P. D. Merica, Vice-President, International Nickel Co., 67 Wall St., New York, N. Y.
W. M. Peirce, Chief, Research Div., New Jersey Zinc Co., Palmerton, Pa.
A. J. Phillips, Superintendent, Research Dept., American Smelting and Refining Co., Barber, N. J.
W. B. Price, Chief Chemist and Metallurgist, Scoville Manufacturing Co., Waterbury, Conn.
S. B. Ritchie, Lieut. Col., Ordnance Dept., Watertown Arsenal, Watertown, Mass.
W. C. Smith, Cerro de Pasco Copper Co, 40 Wall St., New York, N. Y.
Jerome Strauss, Vice-President, Vanadium Corporation of America, 420 Lexington Ave., New York, N. Y.
W. P. Woodside, Vice-President, Climax Molybdenum Corp., 14410 Woodrow Wilson Ave., Detroit, Mich.

TIN SMELTING AND RECLAMATION GROUP

F. W. Willard, *Chairman*, President, Nassau Smelting and Refining Co., 170 Fulton St., New York, N. Y.
P. M. Ambrose, *Secretary*, Metallurgical Division, U. S. Bureau of Mines, Washington, D. C.
W. K. Lewis, Massachusetts Institute of Technology, Cambridge, Mass.
M. F. McConnell, Carnegie Illinois Steel Co., Pittsburgh, Pa.
W. C. Smith, Metallurgist, Cerro de Pasco Copper Co., 44 Wall St., New York, N. Y.
J. F. Thompson, Vice-President, International Nickel Co., 67 Wall St., New York, N. Y.

NONMETALLIC MINERALS GROUP

(In process of organization)

44th A.S.T.M. Annual Meeting and 6th Apparatus Exhibit, June 23 to 27, The Palmer House, Chicago

"Cutting Through a 6-in. Steel Plate with an Oxyacetylene Torch"

Awarded honorable mention, professional class, in the Third A.S.T.M. Photographic Exhibit; submitted by K. A. Kjeldsen, Western Electric Co.

Research Conferences at Gibson Island

WHILE EACH OF THE eight research conferences being sponsored by the American Association for the Advancement of Science at Gibson Island, Md., during the summer would be of interest to many A.S.T.M. members, there are three or four in particular which pertain directly to the field of engineering materials. These are entitled Frontiers in Petroleum Chemistry, scheduled for June 16 through 20; The Structure and Chemistry of Textile Fiber, July 14 through 18; X-Ray and Electron Diffraction, running July 28 to August 1; and Corrosion, from August 4 to 8.

A number of A.S.T.M. members are participating in the program, particularly in the conference on Corrosion which is headed by Dr. R. M. Burns of the Bell Telephone Laboratories, Inc.

At each of the meetings formal papers will be presented outlining the fields of research and directing attention to unsolved problems. Further details of the conferences and information on room reservations and related matters can be obtained from the director of the conferences, Neil E. Gordon, Central College, Fayette, Mo.

Western Metal Congress

A VERY EXTENSIVE program has been announced by the Western Metal Congress to be held under the auspices of the American Society for Metals and other cooperating organizations. The congress will be held May 19 to 23 in the Pan-Pacific Auditorium and the Biltmore Hotel, Los Angeles.

The Southern California District Committee of A.S.T.M. is cooperating in the congress and many active members of A.S.T.M. are contributing to the technical program which includes a series of lectures on heat treatment, inspection of metals, and aluminum. The technical program of the American Welding Society will be of distinct interest to many A.S.T.M. members and the same applies to the Regional Meeting of the American Foundrymen's Association.

Society Appointments

Announcement is made of the following Society appointments:

N. L. MOCHEL, Westinghouse Electric and Manufacturing Co., on the Metallurgical Advisory Board of the National Bureau of Standards, succeeding P. E. McKinney, deceased.

ALLEN D. JONES, General Electric Co., on the Northern California District Committee.

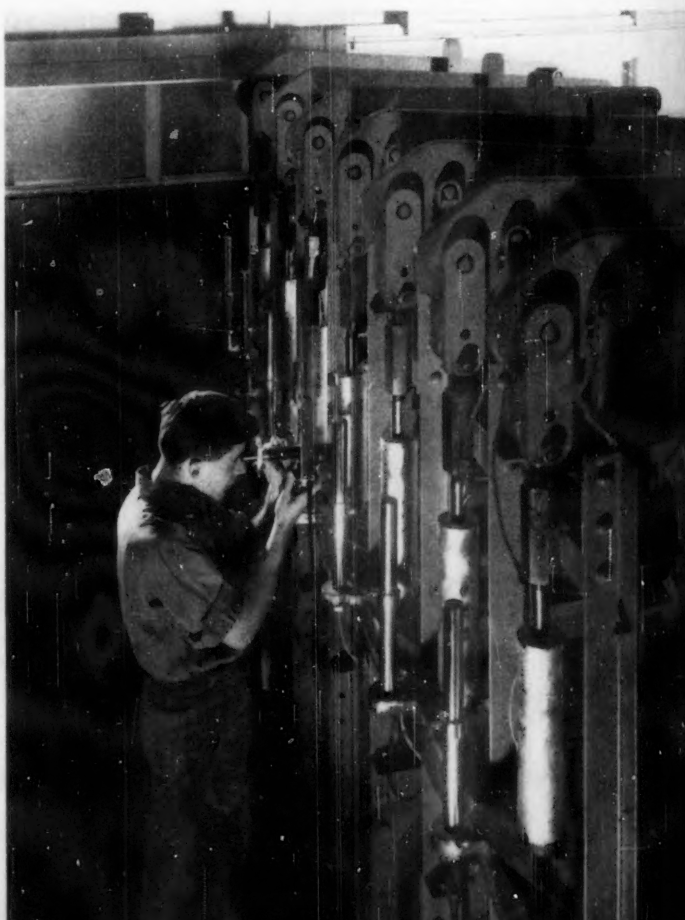
F. M. FARMER, Electrical Testing Laboratories, as one of the Society's representatives on the A.S.A. Standards Council (re-appointment).

H. H. MORGAN, Robert W. Hunt Co., as the Society's representative on the Mechanical Standards Committee, for a term of two years (re-appointment), with R. E. Hess, Assistant Secretary, as alternate.

W. R. BRODE, Ohio State University, on the Inter-Society Color Council, succeeding A. W. Kenney, E. I. du Pont de Nemours & Co., Inc., resigned, as voting delegate; with A. E. PARKER, Electrical Testing Laboratories, as an additional non-voting delegate.

"Creep Measurement"

Awarded third prize, amateur class, in the Third A.S.T.M. Photographic Exhibit; submitted by John B. Flad, Crane Co.



Provisional Program

FORTY-FOURTH ANNUAL MEETING

of the

AMERICAN SOCIETY FOR TESTING MATERIALS

CHICAGO, ILL. **THE PALMER HOUSE** **JUNE 23 to 27, 1941**

	Monday, June 23	Tuesday, June 24	Wednesday, June 25	Thursday, June 26	Friday, June 27
Morning	Registration Committee Meetings	*1st* 10:30 a.m. Formal Opening Session	*5th* Non-Ferrous Metals (continued), Corrosion of Non-Ferrous Metals	*10th* Steel, Effect of Temperature *11th* Timber, Textiles, Paint, Soap, Paper, Fire Tests of Materials	*16th* Concrete and Concrete Aggregates *17th* Iron
Afternoon	Committee Meetings Formal Opening—Sixth Exhibit of Testing Apparatus and Related Equipment	*2nd* 2:30 p.m. Joint Session, with Western Society of Engineers, on Subways and Superhighways	*6th* Electrical Insulating Materials, Rubber *7th* Coal, Coke, Gaseous Fuels *8th* Road and Paving Materials, Bituminous Materials, Petroleum *9th* 4:15 p.m. Marburg Lecture—Dudley Medal Award	*12th* Methods of Testing *13th* Water	
Evening	Committee Meetings	*3rd* Plastics *4th* Non-Ferrous Metals	Cocktail Reception Officers' Night—Sixth Exhibit of Testing Apparatus and Related Equipment	*14th* Fatigue of Metals, Corrosion of Iron and Steel *15th* Cementitious Materials, Building Materials	

Tuesday, June 24 **10.30 a.m.** **First Session**

Formal Opening Session
Presidential Address

Formal Opening of the Forty-fourth Annual Meeting. President W. M. Barr.

Welcome by Chicago Committee on Arrangements.
H. H. Morgan, Honorary Chairman.
E. R. Young, Chairman.

Report of Committee E-9 on Research. G. F. Jenks, Chairman.

Contains a brief discussion on the new research activities being undertaken or sponsored by Society committees, and references to the work of the several research committees.

Report of Committee E-10 on Standards. R. P. Anderson, Chairman.

Reports on specifications and methods of test submitted under the procedure for acceptance and publication of new and revised tentative standards and tentative revisions of existing standards in the interim between annual meetings of the Society.

Address—"Mobilizing Materials for Defense." J. H. Van Deventer, President and Editor, *The Iron Age*.

Annual Report of the Executive Committee. C. L. Warwick, Secretary-Treasurer.

A general report of Society activities with particular reference to membership, publications, finances, and administrative matters relating to committee activities and inter-society relations.

Recognition of Forty-year Members.

Introduction of Newly Elected Officers.

The terms of the new officers, under the provisions of the By-laws, begin at the close of the annual meeting.

Annual Presidential Address—"Speed, Specifications, and Safety." President W. M. Barr, Chief Chemical and Metallurgical Engineer, Union Pacific Railroad Co.

Miscellaneous Business.

Tuesday, June 24 **2.30 p.m.** **Second Session**

Joint Session with Western Society of Engineers, on Subways and Superhighways

This session, sponsored jointly by the Western Society of Engineers and the American Society for Testing Materials, will feature the following:

1. A paper by Ralph B. Peck, Assistant Subway Engineer, Department of Subways and Superhighways on "The Measurement of Earth Pressures in the Chicago Subway."

2. A talk on the general plan of Superhighways is to be given by Charles DeLeuw, Acting Chief Engineer, Department of Subways and Superhighways.

3. A motion picture depicting construction, details in the building of the Chicago Subway.

Tuesday, June 24 8 p.m. Third Session

Held Simultaneously with Fourth Session

Plastics

Report of Committee D-20 on Plastics. W. E. Emley, Chairman.

Considerations being given by the committee to studies of tests for strength properties of plastics, including tests for compression, tensile and impact strength; hardness properties, such as scratch, wear, and abrasion; also optical characteristics such as haze, reflection factor, polymerization, surface irregularities and brightness; and tests for permanence properties including resistance to heat, light, and water are briefly discussed.

Resistance of Plastics to Chemical Reagents. G. M. Kline and R. C. Rinker, National Bureau of Standards, and H. F. Meindl, E. I. du Pont de Nemours and Co., Inc.

The results of tests of the resistance of various types of plastics to chemical reagents made in accordance with A.S.T.M. Method D 543 – 39 T are reported. The plastics used are as follows: molded, cast, and paper-base laminated phenol-formaldehyde resin; molded and paper-base laminated urea-formaldehyde resin; molded and cast polystyrene; cast methyl methacrylate resin; vinyl chloride-acetate resin; vinyl butyral resin; cold-molded bituminous plastic; cold-molded phenolic plastic; cellulose nitrate; cellulose acetate; ethylcellulose; and casein plastic. Resistance of these materials to all of the standard and supplementary reagents listed in the A.S.T.M. method is determined. These reagents include weak and strong acids, weak and strong alkalies, salt solutions, hydrogen peroxide, and organic solvents. Changes in weight, dimensions, and appearance of the test specimens are recorded.

Mechanical Tests of Cellulose Acetate. W. N. Findley, University of Illinois.

Mechanical properties of cellulose acetate as obtained by tests carried on at constant temperature and relative humidity are presented. The tests consist of short-time extensometer tension tests, long-time constant load (time-to-fracture) tension tests, and vibratory bending fatigue tests of notched and unnotched specimens. Several speeds of testing were used in the short-time tension tests. The results show the importance of speed of testing and of surface finish on tensile properties, the notch sensitivity in fatigue and the effect of prolonged static loading on the ultimate strength and the reduction of area in tension.

Factors Influencing the Creep and Cold Flow of Plastics. John Delmonte, Plastics Industries Technical Inst.

In the first portion of the paper, the amount of creep under load and the permanent set after removal of load is determined as a function of time of application of load, at a constant temperature for laminated phenolic plastic, and at a constant fiber stress of 1000 psi. Measurements are made upon a simple cantilever beam supported on a knife edge. Data are also reported for the creep and recovery phenomena of the following plastics: laminated paper-base phenolic, polyvinyl chloride acetate, cellulose acetate-butyrate, cellulose nitrate, polystyrene, and polymethyl methacrylate at temperatures of 20 F., 44 F., 85 F., and 120 F. Measurements were made for a constant fiber stress of 1000 psi., a period of loading for 96 hr., and an equivalent time of unloading. Creep phenomena for 1-hr. periods of loading are also revealed for laminated phenolics and resin-bonded veneers to show the effects of manufacture. The technique of making 1-hr. tests, and the plotting of results by a spark gap are also discussed.

Shear Strength of Molded Plastics. John Delmonte, Plastics Industries Technical Inst.

Shear tests are reported upon numerous injection-molded parts to determine the effect of molding conditions upon the shear strength of the materials. Shear measurements were made with the aid of a punch and die, which were placed under load until the parts were punctured. In compression-molded thermosetting materials, shear measurements were made upon flat disks produced under different periods of cure and different pressures. These tests are performed upon molded pieces shortly after they have been removed from the mold, and after 24-hr. immersion in acetone. A new technique of evaluating flow of molding materials is also discussed, as well as the measurements of shear strength at various points along this path of flow.

Additional data are also revealed for some of the plastics in sheet stock form giving the effect of temperature and conditioning of samples upon the results of shear strength measurements.

Tuesday, June 24 8 p.m. Fourth Session

Held Simultaneously with Third Session

Non-Ferrous Metals

Report of Committee B-2 on Non-Ferrous Metals and Alloys. E. E. Thum, Chairman.

Work is underway on eight new important specifications drafted by the subcommittee on refined nickel and high nickel alloys and a revision of an existing tentative specification. Three of the proposed new specifications cover nickel-chromium-iron alloy sheet, plate and strip; tubes; and bars. A companion group of three new specifications pertain to nickel sheet, plate, and strip; tubes; and bars. There are two new specifications for nickel-copper alloy tubes and bars and revisions in the tentative specifications for nickel-copper alloy plate, sheet, and strip.

The Properties of Certain Lead-Bearing Alloys. Albert J. Phillips, A. A. Smith, Jr., and Paul A. Beck, American Smelting and Refining Co.

The properties of a lead-base bearing alloy containing approximately 12.5 per cent antimony, 3 per cent arsenic and 0.75 per cent tin are compared with conventional lead- and tin-base alloys. At elevated temperatures the new alloy has outstanding properties which are retained after prolonged periods of heating, whereas the standard alloys show considerable softening under such conditions. The new alloy is easy to cast, retains its composition with repeated remelting, and is ductile enough at elevated temperatures to permit shaping. The liquidus temperature is 295 C. and solidus 242.5 C.

Report of Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys. Dean Harvey, Chairman.

The work undertaken by this committee on the subject of metallic materials for radio tubes and incandescent lamps has resulted in the preparation of two new proposed tentative methods of testing wire for lateral wires for grids and wire for supports used in electronic devices and lamps. A new method of test for temper (resilience or springback) of strip and sheet metals, developed at the request of the radio industry, is also submitted as tentative. A proposed method for determining the density of fine wires in radio tubes and incandescent lamps (see paper below) is included as information.

The report also recommends the adoption as standard with revision of the tentative method for bend testing of wire used in radio tubes and incandescent lamps and submits revisions for immediate adoption in the two standard specifications for alloy wires used in electrical heating elements. Announcement is made of work to be undertaken on the development of methods of test for contact metals. The report briefly summarizes work under way in the committee on studies of the life test for resistance wire, significant properties of alloys for use in high temperatures, thermostat metals, and tests for alloys in controlled atmospheres.

Method for Determining the Density of Fine Wire. Stanton Umbreit, RCA Manufacturing Co., Inc.

In the lamp and radio industry, fine wire sizes are expressed in terms of weight per unit length requiring accurate data on density at fine sizes.

A technique is given which is suitable for determining the density of wire from 0.001 to 0.010 in. in diameter using specimens as small as 1 g. with a constancy of about ±0.05 per cent. Determinations on nickel alloys, molybdenum, tantalum, tungsten and platinum alloys are reported on wires about 0.001 and 0.003 in. in diameter.

Report of Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors. J. H. Foote, Chairman.

This report submits as tentative new specifications for bare rope-lay-stranded and bunch-stranded cables made from soft round copper wires for general use as electrical conductors. Several revisions for immediate adoption are presented for inclusion in the specifications for bare stranded copper cable, hard, medium-hard, or soft.

Comparative Value of Arsenic, Antimony and Phosphorus in Preventing Dezincification. W. Lynes, Revere Copper and Brass, Inc.

Dezincification of alpha brasses has been considered in relation to: (1) proper choice of an inhibitor, and (2) evaluation of possible detrimental effects of the inhibitors commonly used. As a basis for the conclusions presented, relevant published and unpublished

information have been studied, abstracted, and correlated; and numerous tests have been made in the laboratory.

The data indicate that dezincification may be successfully suppressed by around 0.03 per cent of arsenic, antimony, or phosphorus without offsetting disadvantages.

The Tensile Properties of Some Copper Alloys. Cyril Stanley Smith and R. W. Van Wagner, American Brass Co.

Tension tests were performed on copper and sixteen copper alloys in the form of commercially fabricated rods, using an extensometer sensitive to 0.0001 per cent. Typical stress-strain curves are reproduced, together with curves showing offset and permanent set on a large scale, both before and after over-straining in tension. Over-strain decreases the stress first producing measurable offset in annealed alloys, but increases the stress needed to produce an equivalent set. Heat-treated beryllium copper follows Hookes' law to very high stresses if appropriate corrections for true stress and strain are made.

Fatigue Tests on Some Copper Alloys. A. R. Anderson and Cyril Stanley Smith, American Brass Co.

Presents the results of short-specimen rotating-beam endurance tests on commercially fabricated rods of tough pitch and oxygen-free copper and fifteen copper alloys, including precipitation-hardening types. Endurance limits, at 300 million cycles, are tabulated, together with pertinent data on composition, fabrication, and tensile properties, while the experimental data are presented in the form of *S-N* curves. The results are briefly discussed and the fatigue machines, preparation of specimens, and testing technique are described.

Wednesday, June 25 9.30 a.m Fifth Session

Non-Ferrous Metals (Continued from Fourth Session), Corrosion of Non-Ferrous Metals

Report of Committee B-6 on Die-Cast Metals and Alloys. J. R. Townsend, Chairman.

This report presents an immediate revision in the chemical composition requirements for alloy XXV of the specifications for zinc-base alloy die castings. Progress is reported on the raising of funds for continuing the atmospheric exposure test research program on zinc-, aluminum-, and magnesium-base alloy die castings, which has been under way for over 12 yr. The report also discusses briefly the work on study of effects of minor alloying elements on aluminum-base alloys, creep studies on tin- and lead-base alloys, and fatigue strength of zinc-base die castings, also a new magnesium-base alloy under consideration.

Papers Appended:

Finishes for Aluminum Die Castings. A. E. Keskulla and Junius D. Edwards, Aluminum Company of America.

Aluminum die castings are covered with a thin, transparent oxide film which constitutes one of their important advantages from a service standpoint. For numerous applications, the ability of aluminum alloys to form and maintain this natural film is sufficient protection, and further finishing is not necessary.

For many other applications, however, where a more decorative appearance or better resistance to service conditions may be desirable, a wide assortment of durable and attractive finishes is available. These finishes, classified as mechanical finishes, chemical finishes, anodic finishes, electroplated finishes, paint and organic finishes are discussed.

Finishing Magnesium Die Castings. H. W. Schmidt, The Dow Chemical Co.

Magnesium die castings, left to mild atmospheric weathering, gradually acquire a layer of oxide, hydroxide or carbonate which protects them from further attack. For most applications, however, the parts should be finished in some manner. The method adopted will depend on the requirements to be met.

Die castings used for interior applications such as business machines, household appliances, etc., are given finishes chosen for their decorative appeal and wearing qualities. For the various exterior applications protective finishing becomes more important and decorative considerations become secondary. All phases of metal finishing in use on magnesium die castings are discussed, including preliminary mechanical finishing, cleaning, chemical treating, and organic finishing.

The Finishing of Zinc Alloy Die Castings. E. A. Anderson, The New Jersey Zinc Co. (of Pa.).

In the use of any metal, consideration of the need for finishing is based on (1) the desire for decorative effects not obtainable in the metal itself, (2) the need for improved wear and abrasion resistance, and (3) the need for protection against special types of corrosive attack. Plated metallic, plated nonmetallic, immersion nonmetallic, and organic finishes may be used for decoration or for protection. In discussing the methods used with zinc alloy die castings, each of the three main fields listed above is considered.

Report of Committee B-7 on Light Metals and Alloys, Cast and Wrought. Sam Tour, Chairman.

As the result of a critical review by the committee of the specifications for aluminum and magnesium alloys under its jurisdiction and in order to provide for certain new alloys, revisions are recommended in sixteen tentative standards. An immediate addition to the specifications for aluminum ingots for remelting is the inclusion of requirements covering a 99.20 per cent grade aluminum. In view of the present increased demand for aluminum for use in iron and steel manufacture, a modification of the zinc content in the 99.4 per cent grade is recommended. Of principal interest in the revision of the specifications for aluminum-base castings is the addition of a new sand casting alloy having good mechanical properties in the as-cast condition. A table of general information with typical yield strengths for the sand casting alloys is presented for inclusion in the specifications as information.

In order to bring the requirements of the various specifications for aluminum wrought shapes in line with present commercial practice, revisions in certain tolerances that have been found necessary are recommended together with a few minor changes in composition requirements. In the specifications covering both cast and wrought magnesium alloys, the committee is proposing additional high-purity grades which offer improved resistance to salt water corrosion, although the mechanical properties are no better than those of the present commercial purity alloys. An appendix to the report gives corrosion data on all the magnesium alloys now covered by A.S.T.M. specifications and also of the proposed new high-purity alloys.

Report of Committee B-8 on Electrodeposited Metallic Coatings. E. M. Baker, Chairman.

This new committee recently organized to take over work on certain electrodeposited metallic coatings previously carried on by three other Society committees has completed and presents as tentative two new specifications. Both specifications cover electrodeposited coatings of nickel and chromium, one applied to zinc-base alloys and the other to copper-base alloys. Revisions are also submitted in the existing tentative specifications for electrodeposited coatings of nickel and chromium on steel and in the test method for local thickness of coatings on steel.

Report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. Sam Tour, Chairman.

Several minor revisions resulting from experience with the salt spray tests are recommended in the present tentative method. Appended to the report is an interesting statistical study of the tensile strength data obtained in the atmospheric corrosion test on samples of 24 non-ferrous metals and alloys. The tabulated data summarizes the arithmetic means and the standard deviations of the tensile strength data obtained from tests at nine exposure locations after periods of 1, 3, and 6 years. Brief reference is made to the work under way on total immersion tests and to the plans for the galvanic and electrolytic corrosion tests of stainless steel coupled with other metals.

Report of Committee B-5 on Copper and Copper Alloys, Cast and Wrought. C. H. Greenall, Chairman.

This extensive report submits fourteen new specifications, two new methods of test, and recommends revisions in twelve tentative standards, the immediate revision of six standards, and the adoption of one tentative standard as standard. Of the fourteen new specifications, seven cover sand castings of widely used copper alloy compositions covered by the ingot specifications issued last year. The remaining seven specifications cover various wrought copper products including leaded red brass (hardware bronze) rods, copper sheet and plate, aluminum-bronze rods, copper-nickel-zinc alloy rods, phosphor bronze rods and wire, and manganese bronze rods. The new methods cover procedures for the expansion pin testing of copper-alloy tubing and the mercurous nitrate test for copper-base alloys.

The work of this committee has been carried on in cooperation with various Governmental agencies including the War Dept., Federal Specifications Board, Navy Dept., Bureau of Aeronautics, and other agencies in the interest of correlating A.S.T.M. standards and corresponding Governmental specifications, particularly those required in connection with the Defense Program.

Influence of Combined External and Internal Stresses on Tendency to Stress Corrosion Crack of Cartridge Brass. Harry P. Croft, Chase Brass and Copper Co.

This paper shows that the tendency to crack depends not only upon the degree, but on the type of cold work; that this tendency in cold-drawn wires obtains a peak at a certain degree of reduction in drawn wires which is not paralleled by wires which are cold worked by other means. Also shown is the fact that the influence of grain size previously shown for annealed metal by another investigator, actually continues through any subsequent cold working operation, and even through the following low temperature, or "relief" anneal.

Mercury Cracking Test, Procedure and Control. H. Rosenthal and A. L. Jamieson, Frankford Arsenal.

Present methods of mercury testing for residual stresses in copper-base alloys have not given satisfactory results. Therefore, a study of the test and its variables has been made. The paper will discuss: solution concentration, solution reuse and replenishment, temperature of solution, sample preparation, time of test, temperature of volatilization, ratio of volume of solution to area of sample's surface, container material and other variables which might affect the test results.

Wednesday, June 25 2 p.m. Sixth Session

Held Simultaneously with Seventh and Eighth Sessions

Electrical Insulating Materials, Rubber

Report of Sectional Committee C59 on Electrical Insulating Materials. H. L. Curtis, Chairman.

Reports on standards being recommended for submittal to the American Standards Association for approval as American standard as well as those now being studied by special reviewing committees looking toward their submittal to A.S.A. for approval as American standard. The committee also announces the preparation of a list of standards in the electrical insulating materials field that have been issued by nationally recognized organizations in this country interested in this subject.

Report of Committee D-9 on Electrical Insulating Materials. T. Smith Taylor, Chairman.

New specifications for laminated tubing for radio applications and two new test methods for volatile content of vulcanized fiber and for preconditioning plastics for electrical insulating materials are submitted as tentative. The report also contains a detailed description of and data obtained in the cooperative investigation of punching quality of laminated phenolic sheets together with a proposed tentative method of test for punching quality developed as a result of this investigation.

A proposed method of test for evaluating sludge formation in transformer oil is included as information as a result of the extensive studies conducted by the committee on this subject. The report also includes as information a proposed method of test for product uniformity of phenolic laminated sheet materials. In addition, revisions are recommended in four tentative standards, and four tentative methods and a tentative revision of one standard method are proposed for adoption as standard.

Papers Appended:

Measurements of Power Factor and Dielectric Constant at Ultra High Frequencies. K. G. Coutlee, Bell Telephone Laboratories, Inc.; R. F. Field, General Radio Co.; E. O. Hausmann, Continental Diamond Fibre Co.; H. R. Meahl, General Electric Co.; and Thomas Hazen, Bakelite Corp.

The theory of the reactance (susceptance) variation method for measuring power factor at ultra high frequencies is discussed and four forms of apparatus are described. The results of round-robin tests on solid dielectrics using these equipments are summarized. In addition, investigations of modifications of the resonant circuit substitution method of D 150 – 39 T to adapt it to ultra high frequencies are reviewed, and both the negative results and valuable by-products of these investigations are given to aid anyone starting to make power factor measurements at ultra high frequencies.

Report on Round-Robin Tests of Power Factor and Dielectric Constant for Glass. Philip A. Richards, RCA Manufacturing Co., Inc.

Samples of five widely different types of glass were circulated among the five laboratories to help in correlating the measuring technique over the range of frequencies for which equipment was available. The data thus accumulated have been assembled and are presented. The participating engineers have met to discuss the methods used with others interested in this work. The results of this have been a recommendation of a method which may be applied with precautions. This is also discussed in the paper.

Report of Committee D-11 on Rubber Products. O. M. Hayden, Chairman.

Three new methods of test are included in this report covering, respectively, procedures for automotive air and vacuum brake hose, tear resistance of vulcanized rubber, and a compression-flexing test for vulcanized rubber. Five tentative standards with revision are recommended for adoption as standard including the specifications for insulated wire and cable, class AO, 30 per cent hevea rubber compound, performance rubber compound, and heat-resisting rubber compound; for rubber sheath compound for electrical insulated cords and cables; and methods of tension testing of vulcanized rubber. The tentative methods of testing flat rubber belting and rubber insulated wire and cable as well as the tentative method of test for indentation of rubber by means of the Pusey and Jones plastometer are recommended for adoption as standard without revision. A revision is presented in the tentative methods of testing sponge rubber products.

A Method for the Test of Adhesive Tape. William C. Geer, formerly B. F. Goodrich Co., now engaged in private research; and W. B. Westcott, Consulting Chemist.

A new linear constant-speed rolling apparatus is described by means of which strips of tape may be applied to any desired relatively thin flat surface under conditions of uniformity of pressure and time.

A new testing method is described which includes a recording mechanism by means of which the force of separation between the tape and the surface is autographically recorded upon a chart. Methods of preparation and handling of the test specimens so that errors of personality may be avoided are also described.

The specific materials tested were cloth-backed industrial tape and paper-backed masking tape. The adhesives were pressure sensitive tapes containing rubber as the basic ingredient.

Wednesday, June 25 2 p.m. Seventh Session

Held Simultaneously with Sixth and Eighth Sessions

Coal, Coke, Gaseous Fuels

Report of Committee D-5 on Coal and Coke. A. C. Fieldner, Chairman.

The tentative method of test for index of dustiness of coal and coke is recommended for adoption as standard and the committee is proposing the withdrawal of the tentative definition of the term coke and the standard specifications for foundry coke. Considerations being given by the committee to a procedure for determining ash of coals unusually high in calcite and pyrite, a method for determining specific surfaces of pulverized coal, sampling of coal for determination of total moisture, and factors effecting the ignitibility of coal and coke are discussed.

A Laboratory Test for the Ignitibility of Coal. Ralph A. Sherman, Battelle Memorial Institute, J. M. Pilcher, formerly Battelle Memorial Institute, now with The Pennsylvania State College, and H. N. Ostborg, Battelle Memorial Institute.

An extended investigation of the method and apparatus for the determination of the ignition temperature of solid fuels developed by the Coal Research Laboratory of Carnegie Institute of Technology is described. The data obtained, principally on bituminous coals, show that of the many variable conditions of test investigated only the particle size materially affects the results. For the same

particle size of fuel, the method appears to measure an inherent characteristic of the different fuels. No predictions are made as to the utility of the data for application to sizes of coal as burned on grates but it is expected that this gap can be bridged.

A Study of the Grindability of Coal and the Fineness of Pulverized Coal when Using the Lea-Nurse Air Permeability Method for Evaluating the Subsieve Fractions. J. B. Romer, The Babcock & Wilcox Co.

The methods now used by the grinding industry for the measurement of grindability and the evaluation of pulverized coal, or finished products, are briefly discussed. The application and interpretation of the results together with their limitations show that there is a need for a better evaluation of the subsieve fractions. The use of specific surface data obained by such methods as the Lea-Nurse air permeability apparatus and the effect on grindability and evaluation of finished products are discussed. It is considered that the data obtained by such methods bring the results in better alignment with the requirements of Rittinger's Law.

Report of Committee D-3 on Gaseous Fuels. A. W. Gauger, Chairman.

A résumé of the activities of six of the subcommittees is presented in this progress report which discusses the work under way on the use of laboratory wet gas meters in the measurement of gaseous samples, the development of a method for conduct of heating value determination by use of the flow calorimeter, and definitions pertaining to calorific value. The report also refers to the studies of eleven instruments for determining specific gravity of gaseous fuels, the preparation of methods for determing various impurities in gaseous fuels, and the investigation of two methods for measurement of moisture in fuel gases by change in color in cobaltous-bromide solution and the infrared absorption of light by water vapor.

Studies on the Measurement of Water Vapor in Gases. F. C. Todd and A. W. Gauger, The Pennsylvania State College.

Presents results of experiments made at The Pennsylvania State College on two methods for determining the moisture content in gaseous fuels. The first is a colorimetric method depending on the change in color of a cobaltous bromide on combining with water of hydration. A colorimeter has been designed and built for this specific application. Spectrophotometric curves used to select the filters for the colorimeter, tables and curves of the performance, accuracy and reproducibility of results with the colorimeter are presented. The second method is a laboratory standard and depends on the absorption by water vapor of a specific wave length in the infrared spectrum. The equipment will be described under results of preliminary tests presented.

Wednesday, June 25 2 p.m. Eighth Session

Held Simultaneously with Sixth and Seventh Sessions

Road and Paving Materials, Bituminous Materials, Petroleum

Report of Committee D-8 on Bituminous Waterproofing and Roofing Materials. J. M. Weiss, Chairman.

Revisions are presented in six tentative specifications for asphalt-saturated roofing in order to have them conform more closely to accepted practice. The adoption as standard of seven tentative specifications covering asphalt coal-tar pitch and bituminous grout for constructing built-up roof coverings and for dampproofing and waterproofing are recommended for adoption as standard, together with the test for coarse particles in asphalt mixtures and test procedures for bituminous mastics. The tentative revision issued in 1939 of the standard specifications for coal-tar saturated felt roofing for waterproofing and constructing built-up roofs is recommended for adoption as standard with the addition of a revised clause on basis of rejection.

Report of Committee D-4 on Road and Paving Materials. J. E. Myers, Chairman.

New test procedures are recommended as tentative for determining modified miscibility of emulsified asphalts and a procedure for cement mixing of emulsified asphalts developed as the result of an exhaustive investigation by the subcommittee on emulsion tests. Changes providing for the testing of a wider range in grading of aggregates are submitted as a tentative revision of the standard test for abrasion of coarse aggregate by the Los Angeles machine. The report discusses briefly work under way on the preparation of specifications for slow-setting emulsified asphalts for fine aggregate mixes, new specifications for sodium chloride, and a revision of the present methods of chemical analysis of calcium chloride.

The Influence of Recovery Temperature on the Ductility of Recovered Asphalt. Carl Bussow, A. W. Dow, Inc.

Asphalts refined from several crudes by different refining methods are dissolved in benzol and recovered by the Bussow method, using maximum asphalt temperatures of 250 C. and 300 C. Penetration, ductility, softening point, loss on heating, and penetration after loss on heating are determined and compared with the original asphalt. The asphalts range from 15 to 100 cm. in ductility and yield conclusive data on the effect of maximum recovery temperature on the ductility of the recovered asphalt.

Fundamental Significance of Oliensis Spot Test—Quantitative Tests for Homogeneity. G. L. Oliensis, Barber Asphalt Corp.

It is shown that fundamentally the function of the spot test is to distinguish between those asphalts having a relatively stable internal-phase relationship that can stand successfully the flocculating force exerted by the test, and those asphalts in which that phase-relationship is relatively unstable (whether through cracking, overheating, or the presence of incompatible bodies) so it cannot resist that flocculating force.

Two quantitative tests for homogeneity are proposed—one depending on the number of days required for a "negative" solution to become "positive"; the other based on the amount of hexane the "negative" solution can absorb before becoming "positive." Their value is discussed in detecting slight overheating or small additions of "positive" asphalts.

Report of Committee D-18 on Soils for Engineering Purposes. C. A. Hogentogler, Chairman.

Proposed definitions of terms with units and symbols relating to soil mechanics are included in this report as information prior to their submittal to the Society as tentative subsequent to the annual meeting. The report discusses plans for a symposium on tests of soils for engineering purposes to be sponsored by the committee at the 1942 annual meeting of the Society.

Report of Committee D-2 on Petroleum Products and Lubricants. T. A. Boyd, Chairman.

This extensive report contains new tentative specifications for aviation gasoline and four new methods of test for knock characteristics of aviation fuels, ignition quality of Diesel fuels, carbonizable substances in paraffin wax, and aniline point of petroleum products. Following extensive studies the committee is recommending as tentative a revised test for neutralization number of petroleum products and lubricants. Two proposed methods, included as information, describe procedures for neutralization number of oxidized petroleum by electrometric titration and a rapid method which is a modification of the procedure presented as tentative. A more rapid method of test for saponification number which uses methyl ethyl ketone is presented as tentative together with a revised and improved test for sulfur in petroleum oils by lamp method.

The report also includes a proposed method for potential gum in aviation gasoline which is essentially a combination of the two existing methods for gum stability and gum content with provision for correction in the case of gasolines containing tetraethyl lead. A revised Diesel fuel oil classification is included as information. Revisions in three standards are proposed and the adoption as standard of three tentative methods is recommended.

A proposed method for conversion of kinematic viscosity to Saybolt furol viscosity is published as information. Immediate revisions are presented in the tentative methods of test for gum stability of gasoline and for tetraethyl lead in gasoline.

Report of Sectional Committee Z11 on Petroleum Products and Lubricants. T. A. Boyd, Chairman.

Reports on standards being recommended for submittal to the American Standards Association for approval as American standard.

Performance Specifications for Greases. Robert C. Adams and Harrison E. Patten, U.S.N. Engineering Experiment Station.

Special testing equipment and methods for its use are described in connection with the performance specifications which are being developed by the Navy. Plasticity, leakage, bleeding, and resistance to oxidation are measured under accelerated or simulated service conditions and the specification requirements are based upon these results instead of upon composition. Performance testing permits the identification and purchase of superior greases with reduction in costs of lubrication despite some increase in unit cost.

Wednesday, June 25 4.15 p.m. Ninth Session

Marburg Lecture—Dudley Medal Award

Edgar Marburg Lecture.

The purpose of the Edgar Marburg Lecture is to have described at the annual meetings of the Society, by leaders in their respective fields, outstanding developments in the promotion of knowledge of engineering materials. Established as a means of emphasizing the importance of promoting knowledge of materials, the Lecture honors and perpetuates the memory of Edgar Marburg, first Secretary of the Society.

Sixteenth Edgar Marburg Lecture: "Natural and Synthetic Rubbers." By H. L. Fisher, Associate Director, U. S. Industrial Chemicals, Inc.

Award of Charles B. Dudley Medal.

To C. W. MacGregor, Associate Professor of Applied Mechanics, Massachusetts Institute of Technology.

The Fifteenth Award of the Charles B. Dudley Medal will be made to C. W. MacGregor, Associate Professor of Applied Mechanics, Massachusetts Institute of Technology, for his paper on "The Tension Test," presented before the Society at the 1940 Annual Meeting.

An annual award is made to the author or authors of a paper of outstanding merit constituting an original contribution on research in engineering materials. Established as a means of stimulating research in materials and of recognizing meritorious contributions, it commemorates the name of the first President of the Society.

Cocktail Reception

Immediately following the Tenth Session, the Chicago Committee on Arrangements will be hosts at a cocktail reception when all members, guests, and ladies will have an opportunity to meet the outgoing and incoming officers of the Society.

Wednesday, June 25 Evening

Officers' Night—Sixth Exhibit of Testing Apparatus and Related Equipment

Thursday, June 26 9:30 a.m. Tenth Session

Held Simultaneously with Eleventh Session

Steel, Effect of Temperature

Report of Joint Committee on Definitions of Terms Relating to Heat Treatment. H. S. Rawdon, Chairman.

Report of Committee E-4 on Metallography. L. L. Wyman, Chairman.

This report summarizes the progress of work under way in the committee on the preparation of recommended practices for five of the more important procedures used in the metallographic applications of X-ray diffraction, also to a survey being made of dilatometric methods. Work is being undertaken on a study of ferrite grain size and on the procedure for use of the grain size comparator in metallographic studies. Reference is made to the important studies being made of the various methods of measurement of nonmetallic inclusions looking toward the preparation of a standard reference chart for inclusions.

Report of Joint Research Committee on Effect of Temperature on the Properties of Metals. N. L. Mochel, Chairman.

A brief summary of the progress made during the year in the various research projects sponsored by the joint committee. These include tests of tubular members at elevated temperatures, properties of metals at low temperatures, relation of torsion-creep and tension-creep, relaxation tests, and study of high-temperature test methods.

Paper Appended:

Study of Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures. H. W. Gillett, H. W. Russell, S. L. Hoyt, and H. C. Cross, Battelle Memorial Institute.

The Effect of Carbide Spheroidization upon the Creep Strength of Carbon-Molybdenum Steel. S. H. Weaver, General Electric Co.

The progressive changes in the properties of a steel with time at stress and temperature affect design stresses and the service life of high temperature equipment. Test data were obtained from a plate of carbon-molybdenum steel cut into four parts and differently heat treated to produce the following structures: fine grained normalized, fine grain annealed, coarse grained normalized, and coarse grained annealed. In addition to the initial treatments, a part from each of the four groups was given a short and a longer spheroidization time making twelve different conditions of the material. Two independent long time creep tests were run on each of the twelve conditions, one at 900 F. and one at 1000 F. and the creep strengths so determined together with the resulting physical properties are reported.

The Fabrication of Carbon-Molybdenum Piping for High-Temperature Service. R. W. Emerson, Pittsburgh Piping and Equipment Co.

Since considerable emphasis has been placed on the necessity for proper grain size, photomicrographs and macrographs are presented to illustrate the effects of hot bending, upsetting, and welding on the microstructure of carbon-molybdenum steel in both the "as fabricated" and final heat-treated condition. In addition to microstructural analysis results of hardness determinations, bend tests, and room temperature tension tests are given. A discussion of the effect of heat-treating temperature, cooling rate, and melting practice on the final grain size is given, including photomicrographs showing the coarsening characteristics of both coarse and fine grain (low and high-coarsening temperatures, respectively) steel.

Report of Committee A-1 on Steel. N. L. Mochel, Chairman.

Of particular interest among the numerous recommendations made in this report are six proposed new tentative specifications covering important materials in widespread use. One for low-alloy structural steels provides standardized requirements for these products which are characterized by relatively high yield points; alloying elements, other than carbon, are optional with the manufacturer, but if purchased for welding, the suitability of the chemistry is to be based on evidence acceptable to the buyer. Carbon and alloy-steel ring and disk forgings are covered in a companion specification to the four tentative standards published last year covering forgings for general industrial and railroad use. Proposed new tentative specifications will be offered as a revision of the standard specifications for carbon-steel and alloy-steel blooms, billets, and slabs for forgings, and since this standard is basic in the forging group, it will be retained for a year or more.

Two proposed specifications for light gage structural quality sheets incorporate standardized physical and chemical requirements which have been urgently needed, particularly in the construction field. The sixth new specification covers heat-treated wrought steel wheels.

Proposed for immediate adoption as a standard is a new specification covering hot-worked high-carbon steel tie plates following closely an existing A.A.R. standard.

Several tentative specifications are recommended for adoption as standard and quite a number of revisions are proposed; for the most part those involving standards are not for immediate adoption.

Report of Sectional Committee B36 on Standardization of Dimensions and Materials of Wrought-Iron and Wrought-Steel Pipe and Tubing. H. H. Morgan, Chairman.

The efforts of the sectional committee in endeavoring to further more general acceptance of the American Standard B36.10-1939 are reported.

Compression and Tension Tests of Structural Alloys. Bruce Johnston, Lehigh University, and Francis Opila, Baldwin-Southwark Corp.

The tests include precise determinations of the upper and lower yield strength and modulus of elasticity, all in both compression and tension. All tests are made both with and across the direction of rolling. The materials include many of the currently used structural metals such as carbon structural, silicon structural, six structural steels from various sources commonly called low-alloy, and copper-bearing nickel steels, together with several samples of structural aluminum alloy. There are over 35 different samplings of plate material, all from different heats. Included is a study of several variables involved in the testing technique.

Report of Committee A-9 on Ferro-Alloys. Charles McKnight, Chairman.

The present tentative specifications for spiegeleisen and for ferrochromium are recommended for adoption as standard. Progress is reported on considerations being given to the preparation of specifications for silicomanganese, ferrotitanium, and ferroboron.

Report of Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys. Jerome Strauss, Chairman.

Several minor revisions resulting from experience with the plant corrosion tests are presented. Minor changes in the specifications for corrosion-resisting alloy steel sheet, plate, and strip are also recommended.

Included as an appendix is a report describing studies of structural constituents and etching of the 18 per cent chromium, 8 per cent nickel types of alloy steel. Photomicrographs of the various steel specimens after heat treatment using several etching reagents for revealing carbides are included. Reference is made to the considerations being given by the committee to the preparation of specifications for stainless tubing and to work to be undertaken in cooperation with the Alloy Castings Research Institute and the American Petroleum Institute on studies of the test block for heat-resisting alloys made at the Battelle Memorial Institute and their relation to A.S.T.M. specifications for stainless steel castings. The tables of data covering corrosion and heat-resisting alloys being compiled by the subcommittee on classification of data are now being completed.

The Stress-Strain Characteristics of Cold-Rolled Austenitic Stainless Steels in Compression as Determined by the Cylinder Test Method. Russell Franks and W. O. Binder, Union Carbide and Carbon Research Labs., Inc.

The paper describes the stress-strain characteristics of the steels in tension and compression. It also contains a procedure developed at the authors' laboratories for determining these properties of thin sheets of cold-rolled 18–8 steels in compression. This procedure will be of interest because the compressive properties of thin sheets are not easily determined, particularly when the material has such high strength.

A New Free-Machining Addition for Stainless Steels. H. Pray, R. S. Peoples, and F. W. Fink, Battelle Memorial Institute.

The addition of small amounts of bismuth (0.1 to 0.5 per cent) to the corrosion-resistant stainless alloys results in a remarkable and useful increase in their machinability with no detriment to, and in some cases, an improvement in their corrosion resistance. The paper describes laboratory data relative to the effect of bismuth on the machinability, corrosion resistance to a variety of media and conditions, physical properties at ordinary and high temperatures, galling resistance and the hot and cold working properties of several of the more common stainless alloy types. The general metallurgy of the bismuth-containing alloys is discussed. The laboratory data and results are substantiated by plant and service experience.

Thursday, June 26 9.30 a.m. Eleventh Session

Held Simultaneously with Tenth Session

Timber, Textiles, Paint, Soap, Paper, Fire Tests of Materials

Report of Committee D-7 on Timber. Hermann von Schrenk, Chairman.

Recommends the adoption as standard of the tentative method of test for tar acids in creosote and creosote coal-tar solutions. The revised definition of water-gas tar is also recommended for adoption as standard in cooperation with other interested committees.

Tests of Glued Laminated Wood Beams Impregnated with Creosote. William A. Oliver, University of Illinois.

Fabricating untreated wood structural units with glue as the fastener may now be considered as one of our standard methods of construction. However, these same units treated with a preservative have not been used. This paper reports upon a series of tests of glued laminated beams treated with creosote.

The specimens were the size of the A.S.T.M. standard for small clear specimens to be treated in cross bending. Two control beams of the same size—one of solid wood, untreated, and the other a glued laminated one, untreated—were also tested with each treated specimen. Twelve groups of specimens were tested at approximately three-month intervals over a period of 1 yr.

Results show that the glued and treated beams develop the same strength as the plain beams or the glued untreated ones.

Report of Committee C-5 on Fire Tests of Materials and Construction. R. P. Miller, Chairman.

This report presents a new method of fire test applicable to untreated wood and wood chemically treated by impregnation to reduce flammability for permanent use in construction. The comprehensive investigation upon which this method is based is presented in the appended subcommittee report on comparative fire tests.

The report recommends the adoption as standard of the tentative methods of fire tests of door assemblies and incorporation of the tentative revisions submitted last year in the standard fire tests of building construction and materials.

Report of Subcommittee II, Committee C-5:

Report on Comparative Fire Tests of Treated and Untreated Wood (prepared by W. J. Krefeld).

Report of Committee D-10 on Shipping Containers. Edward Dahill, Chairman.

This progress report discusses plans of the committee to organize two subcommittees: one to undertake work on the development of test methods for complete shipping containers, and the other to develop test procedures for materials and accessories, used in the construction and packing of shipping containers.

Report of Committee D-1 on Paint, Varnish, Lacquer, and Related Products. H. E. Smith, Chairman.

This extensive report presents six new pigment specifications covering diatomaceous silica, barium sulfate, mica, aluminum silicate, magnesium silicate, and lead titanate, also new specifications for oiticica oil, liquid paint driers, and dibutyl phthalate. For the methods of testing liquid paint driers, new procedures are presented for determining cobalt by the electrolytic and gravimetric methods and for determining iron by the volumetric method, also a new test for color of orange shellac.

In connection with its work on weathering tests, the committee is presenting as tentative new methods for preparation of steel panels for exposure tests of enamels for exterior service, and for evaluating the degree of resistance to rusting obtained with paint on iron or steel surfaces. Two important items in the report are the revised tentative method for measuring specular gloss of paint finishes and the revised definitions of terms relating to paint, varnish, lacquer, and related products. Revised requirements for sampling are presented for inclusion in 26 pigment specifications. Revisions are submitted in five tentative specifications and three test methods, while four tentative specifications and three methods are recommended for adoption as standard.

Report of Committee D-17 on Naval Stores. F. P. Veitch, Chairman.

Consideration is being given by the committee to studies of the shouldered ring in softening point tests of resins and rosins, and to procedures for determining acid number and saponification value. The report includes data obtained in cooperative tests on the crystallizing tendency of rosins.

Report of Committee D-13 on Textile Materials. H. J. Ball, Chairman.

Two proposed new specifications for medium-weight cotton corduroy fabrics and for fire-retardent properties of treated textiles, and new tentative methods of testing woven asbestos tubular sleeving and for evaluating compounds designed to increase resistance of textiles to insect pests are presented. Revised standard methods for fastness of colored textiles to light and for cotton textiles to laundering are given, together with revised tentative tests for resistance of textile fabrics and yarns to insect pests and specifications for bleached cotton broadcloth. New requirements for twist testers to be added to the standard specifications for textile testing machines are recommended for publication as tentative. Minor changes in determination of inside diameter and yards per pound of tubular sleeving are proposed for immediate adoption. The adoption as standard with slight modifications of the methods of testing single jute yarns is recommended. The present tentative specifications for asbestos yarns are proposed for adoption to replace the existing standard.

The Effect of Rate of Loading on Tensile Strength of Cord and Yarn. M. Castricum and A. N. Benson, U. S. Rubber Co.

Test results obtained on an inclined-plane cord testing machine, having a variable speed drive, have been analyzed to show that there is a linear relation between the strength of a cotton tire cord and the logarithm of the rate at which the breaking load is applied. The equation obtained is also shown to apply to previously published data on rayon yarns and cotton ropes.

Report of Committee D-12 on Soaps and Other Detergents. H. P. Trevithick, Chairman.

New specifications for olive oil chip soap and a test for carbonates as carbon dioxide in soaps and soap products are presented. Revisions are recommended in the specifications for palm oil chip soap and olive oil solid soap. Three new tentative definitions are presented and seven existing definitions of terms relating to soaps and other detergents are revised. Five specifications for soaps and detergents and methods of chemical analysis of sulfonated oils are recommended for adoption as standard. Revisions in the standard methods of analysis of soaps include a procedure for determining free alkali, matter insoluble in water, changes in the titer test, and omission of the modified Wolff method for rosin. The report also summarizes briefly the work being carried on by its subcommittees on sulfonated detergents, performance tests and specifications for dry cleaning detergents, and analysis of soap detergents.

Report of Committee D-6 on Paper and Paper Products. L. S. Reid, Chairman.

A group of new methods of test for paper has been completed by the committee covering procedures for determining folding endurance (by the Schopper and M.I.T. testers), thickness, moisture, and basis weight. Four of the present tentative methods are recommended for adoption as standard covering tests for machine direction, bulking thickness, acidity or alkalinity, and the determination of resin in paper. Some seventeen additional paper testing methods being studied by the committee are listed.

Progress is reported on the preparation of a monograph covering the significance of tests which will include a detailed discussion concerning the application of some 26 procedures used in evaluating ten different types or grades of paper.

Progress is reported on studies of tests for fiberboard and fiberboard containers, including the preparation of proposed methods for conditioning, a compression test procedure, also work under way on bursting tests, moisture content, drum, and puncture tests.

Thursday, June 26 2 p.m. Twelfth Session

Held Simultaneously with Thirteenth Session

Methods of Testing

Report of Committee E-8 on Nomenclature and Definitions. Cloyd M. Chapman, Chairman.

This progress report discusses the work of the committee in reviewing the definitions prepared by other Society committees and the considerations given to several general important questions dealing with nomenclature as applied to engineering materials.

Report of Committee E-2 on Spectrographic Analysis. H. V. Churchill, Chairman.

This progress report discusses briefly the considerations being given by the committee to fundamental methods and technique; also quantitative methods and their application, and accessory uses of the spectrograph.

Report of Committee E-3 on Chemical Analysis of Metals. G. E. F. Lundell, Chairman.

The extensive study of analytical procedures and sampling methods for non-ferrous metals being made by this committee has resulted in the completion of new chemical methods for analysis of pig lead, slab zinc, and of metallic electrical heating alloys. These three new methods will be presented as tentative to the Society subsequent to the annual meeting.

Report of Committee E-7 on Radiographic Testing. H. H. Lester, Chairman.

Considerations being given by the committee to the preparation of recommendations on radiography of test metal and the radiographic examination of welds and weldments are briefly discussed in this report.

Report of Committee E-1 on Methods of Testing. W. H. Fulweiler, Chairman.

Revised methods of impact testing of metallic materials included in this report were completed after detailed study by the committee and as a result of the information and data obtained in the 1938 symposium. New proposed tentative specifications are included for three thermometers used in the aniline test of petroleum products, and a new titer test thermometer for soaps and other detergents. An important contemplated revision in the high-distillation thermometer is included as information.

The research studies at the University of Illinois on effect of speed of testing reported by the committee last year have resulted in the preparation of a report on "Effect of Rate of Strain on Yield Strength, Tensile Strength, Elongation, and Reduction of Area in Tension Tests" by P. G. Jones and H. F. Moore appended to the report.

Data obtained at Watertown Arsenal on tests of low-alloy steel plates of five thicknesses are included in a report by G. F. Jenks on "Effect of Specimen Shape and Size on Measured Values of Tensile Properties" appended to the report.

Announcement is made of the initiation of a committee research project at Brooklyn Polytechnic Institute to determine whether the results of empirical flow tests can be expressed in absolute units. Tests of typical materials by the ring-and-ball softening point test and by three calibrating methods (falling and rotating concentric cylinders and the Bingham-Murrey capillary tube) are being made first.

Activities of the technical committees on mechanical testing, consistency and plasticity, particle size and shape, interpretation and presentation of data, designation and interpretation of numerical requirements, conditioning and weathering tests, and laboratory apparatus are briefly described. Reference is made to work to be undertaken on the determination of hydrogen ion concentrations and its importance in the processing of materials.

Paper Appended:

Methods of Testing Volumetric Glassware. J. J. Moran, Kimble Glass Co.

The paper covers referee methods of testing volumetric glassware which can be used to check the accuracy of graduated ware supplied under A.S.T.M. specifications. The proper method of reading a meniscus is discussed as well as the cleanliness required of apparatus before it can be recalibrated. A proper method of setting liquids on the calibration mark preparatory to reading as well as some comments on the liquids to be employed in testing are also given. The proper precautions to use when making a gravimetric calibration and also a volumetric calibration are outlined.

Statistical Theory of the Effect of Dimensions and of Method of Loading upon the Modulus of Rupture of Beams. John Tucker, Jr., National Bureau of Standards.

It has long been evident, from investigations of the strength of materials, that even duplicate specimens made from the same piece or portion of the material will differ in strength. This inherent variation of strength is readily understandable in concrete made of cement and varied sizes of aggregates.

Based on the strength of a unit volume or area of the material, and the dispersion or variation in the strengths of such unit, it is shown that the strengths and strength dispersions of specimens of varied sizes and shapes may be computed and the following theorems are developed:

For beams of one depth and span, the greater the width the less the dispersion in modulus of rupture.

For beams of one cross-section, the longer the beam the less the modulus of rupture and the less the dispersion in the modulus of rupture.

For beams centrally loaded the modulus of rupture is greater than the modulus of rupture of the same size beam loaded at third points.

Address—"The Electron Microscope and Its Uses." R. Bowling Barnes, Director, Physics Division. American Cyanamid Co.

This address will describe some of the applications which have been found for the R.C.A. electron microscope recently installed in the Stamford Research Laboratories of the American Cyanamid Co. This instrument is the first commercially built electron microscope to be used in this country. Preliminary work has indicated that the microscope will prove particularly valuable in particle-size determinations of pigments, catalysts, and other materials which at present are beyond the limits of observation by ordinary optical methods. Similarly, materials which form continuous films such as resins or synthetic rubber are amenable to study with the usual methods of electron microscopy. The study of bacteria, viruses, and other types of biological materials is also possible. The reviewer will describe these and other applications and will discuss the various limitations which the electron-optical method of observation presents. The techniques which are ordinarily used for specimen preparation and mounting will be discussed in an effort to point out which materials can, and which cannot be studied under the electron-microscope using the techniques of specimen preparation at present available. The method of operation of the instrument will be touched upon to indicate the simplicity and versatility of this instrument.

Thursday, June 26 2 p.m. Thirteenth Session

Held Simultaneously with Twelfth Session

Water

Report of Committee D-19 on Water for Industrial Uses. Max Hecht, Chairman.

The adoption as standard is recommended of three existing tentative methods covering, respectively, sampling plant or confined waters for industrial uses, determination of the hydroxide ion in industrial waters, and reporting results of analysis of industrial waters. A brief summary of committee activities is presented, particularly the considerations being given to the development of sampling methods for water at atmospheric, superatmospheric, and subatmospheric pressures in vapor and solid states and waste water. It reports work under way on the preparation of routine methods for determining sulfates, calcium, magnesium, phosphates, sulfites, and dissolved oxygen in water.

Report of Joint Research Committee on Boiler Feedwater Studies. C. H. Fellows, Chairman.

Symposium on Problems and Practices in Determining Steam Purity by Conductivity Methods

Introduction. R. E. Hall, Hall Laboratories, Inc.

The Sampling of Steam and Boiler Water. A. R. Belyea and A. H. Moody, Consolidated Edison Company of New York, Inc.

The principles of representative sampling as applied to the sampling of steam and boiler water are reviewed. The extension of steam temperatures and pressures to higher values in modern steam-boiler and turbine design imposes stricter requirements in the sampling of steam and boiler water, especially as regards accuracy and freedom from traces of contamination from sampling equipment. Sampling lines, cooling coils and sample containers must preserve the integrity of the sample by suitable choice of materials of construction. Metals and alloys for this purpose are discussed from the standpoint of corrosion resistance in the presence of the chemical impurities in the steam, boiler waters, and cooling water.

Experimental Methods of Determining Conductivity Correction Factors for Dissolved Gases in Steam Condensate. S. F. Whirl, Duquesne Light Co.

This paper presents a critical survey of the different procedures which have been advocated for correcting conductivity measurements on steam condensate samples for the presence of interfering dissolved gases, principally carbon dioxide and ammonia. Because of inaccuracies or involved analytical procedures, none of these is entirely satisfactory. A simple distillation method developed in the author's laboratory, involving removal of the gases from the sample and collection in relatively pure water, followed by a conductivity measurement, appears logical and is presented and discussed in detail.

Calculation of Corrections to Conductivity Measurements for Dissolved Gases. D. S. McKinney, Carnegie Institute of Technology.

Methods for calculating the corrections to be applied to conductivity measurements are presented based partly upon the methods previously discussed by the author in the paper on "The Calculation of Equilibria in Dilute Water Solutions" in the 1939 *Proceedings*. An improvement of the method of A. Watson is proposed. Tables are presented showing (1) the ionic equivalent conductance of the ions commonly found in industrial water, (2) the variation of Λ with concentration for Na_2SO_4, NaCl, and NaOH, and (3) the distribution of the ions of the weak electrolytes H_2O, H_2S, CO_2, SO_2, NH_3, and H_3PO_4 as a function of pH.

An example is included illustrating the method of calculating the correction to be applied to a steam sample from partial analysis of steam and boiler water.

The Degasification of Steam Samples for Conductivity Tests. P. B. Place, Combustion Engineering Co.

This paper is a summary of the methods and equipment available for the elimination from steam samples of gaseous impurities that affect conductivity measurements. The principles involved in the various methods are briefly discussed and the apparatus as developed by various investigators is described.

In their present state of development, continuous flow degasifiers will reduce carbon dioxide to an amount that constitutes a negligible conductivity error for commercial testing. At least one investigator claims complete elimination of both carbon dioxide and ammonia. With proper control of time, temperature, scavenging, and surface it appears that complete elimination is possible.

A New Type of Conductivity Apparatus for Use with Boiler Waters and Steam Samples. A. R. Mumford, Consolidated Edison Company of New York, Inc.

A new type of conductivity apparatus for use with boiler waters or steam samples is described. Gas contamination is prevented in the case of steam samples by condensing in contact with the vapor phase and slight venting. Degasification of water samples is secured by flashing and venting the vapor phase. The cell is designed for use at full steam pressure and saturation temperatures. Measurement of conductivities at elevated temperatures as compared to "standard" temperatures reduces hydroxyl ion correction to a negligible amount.

The apparatus is rugged, uses very little cooling water, may be installed adjacent to the sampling point, makes possible simple recovery of condensate, makes possible continuous readings without appreciable time lag, and will be undamaged by failure of cooling water.

Conductivity Cells and Electrical Measuring Instruments.

Thursday, June 26 8 p.m. Fourteenth Session

Held Simultaneously with Fifteenth Session

Fatigue of Metals, Corrosion of Iron and Steel

Report of Research Committee on Fatigue of Metals. H. F. Moore, Chairman.

This report presents a detailed description of and results obtained in the investigation of the effect of different types of testing machines on the endurance limit of metals and on the shape of the *S-N* (stress-cycle) diagram. The machines studied included the rotating beam, the rotating cantilever beam, vibratory flexural, and direct axial stress. The tests were made on high-strength heat-treated alloy steel, medium-strength low-carbon steel, and an aluminum alloy (duralumin). The report presents profilograph records, magnaflux tests, and photomicrographs of the metals studies together with a series of curves and a discussion of the variation of endurance limits obtained on the different machines; also the effect of shape of specimen and the endurance above the endurance limit.

The Effect of Shot Blasting and Its Bearing on Fatigue. W. M. Murray and J. M. Lessells, Massachusetts Institute of Technology.

In order to prevent the formation of fatigue cracks and the eventual breakdown of structural parts under the action of repeated stressing means have been employed for producing better surface finish and for artificially raising the endurance limit.

The authors present an analysis of the effects due to shot blasting and its influence upon steels in different conditions. In some cases shot blasting can be very advantageous but this depends upon the use to which the material is to be subjected as well as its condition. Test results are given to confirm the analysis and to illustrate the relative advantages due to this type of surface finish.

Fatigue Comparison of 7-in. Diameter Solid and Tubular Axles. O. J. Horger and T. V. Buckwalter, Timken Roller Bearing Co.

Rotating cantilever beam fatigue tests were made on axles about 7 in. in diameter using steels having an analysis approximating S.A.E. 1045. Comparison of axle fatigue resistance due to a press-fitted wheel is made between "as forged" solid members and seamless tubes in "hot rolled" and several conditions of heat treatment.

Results show that tubular axles having high tensile strength values may or may not exhibit greater fatigue strength than those having lower physical properties. Observations on the effect of residual stresses are given. Some tubular axles show greater fatigue strength than the solid ones.

Pitting and Its Effect on the Fatigue Limit of Steels Corroded Under Various Conditions. D. J. McAdam, Jr., and G. W. Geil, National Bureau of Standards.

The form, size, and distribution of corrosion pits have been studied after stressless corrosion of various steels in streams of well water, distilled water, and Severn River water, and in sprays of soft water and normal salt solutions. The results of the examination are correlated with the lowering of the fatigue limit, and with the effective stress-concentration factor. The effective stress-concentration factor depends on the form, size, and distribution of the pits and on the notch sensitivity of the steel. A discussion of the influence of cyclic stress (during corrosion) on the pitting of steels in well water and distilled water is presented.

A New High-Temperature Fatigue Machine. W. P. Welch and W. A. Wilson, Westinghouse Electric and Manufacturing Co.

A new machine for the rapid determination of the endurance limit of steels at high temperatures is described. The specimen is stressed in alternating bending at a frequency of 120 cycles per second and is driven at constant amplitude by a reciprocating electromagnetic motor supplied with 60-cycle power from the house line. Since the machine operates very close to resonance, an electronic control is provided to maintain constancy of amplitude despite the small changes in the line frequency ($\pm 1/3$ per cent) which occur on a well-regulated power system.

The results of operating experience over a period of 1 yr. is reported along with test results showing the quality of the data that have been obtained.

Testing Material in the Resonance Range. R. K. Bernhard, The Pennsylvania State College.

The effect of the amplification factor at or near resonance can be used advantageously in testing materials. The fundamental principle governing the investigations at or near resonance are discussed. An oscillator-driven endurance test machine based on the resonance principle is described more in detail, including control units and calibration. The main purpose of this machine is to test larger specimens and riveted or welded structural units; static and dynamic load conditions, alone or superimposed, can be produced at high frequencies, requiring a rather small power input for the driving motor. A few test data are presented.

Report of Committee A-5 on Corrosion of Iron and Steel. W. H. Finkeldey, Chairman.

The tentative specifications for zinc-coated steel wire strand (classes B and C coatings), and for zinc-coated strand (galvanized and "extra galvanized") are recommended for adoption as standard, the latter to replace the existing standard. The general Preece test for determining uniformity of coating by copper sulfate dip on galvanized articles is also recommended for formal adoption to replace the two other existing methods.

The major part of this report is devoted to presentation of results and observations obtained in the exposure tests of fence wire and farm-field fencing being conducted at eleven test sites. The conditions of the specimens at the various test locations after about four years' exposure are recorded in the inspection data.

Additional failures of the copper-bearing and non-copper-bearing black corrugated sheets exposed to the atmosphere at Annapolis since 1916 are reported. This report includes the final results obtained in the total immersion tests on the behavior of seamless steel pipe of low and high copper contents exposed to sea water at Portsmouth, N. H , and Key West, Fla.

An Accelerated Atmospheric Corrosion Test. H. Pray, Battelle Memorial Institute, and J. L. Gregg, Bethlehem Steel Co.

As a part of an extended investigation of the atmospheric corrosion resistance of ordinary and low-alloy steels a test procedure and equipment have been developed which are capable of predicting in a few weeks the relative atmospheric corrosion rates for materials of this type. The paper includes a general discussion of atmospheric corrosion testing, a description of the procedure and apparatus used for the accelerated test and a comparison of the accelerated and actual atmospheric tests for a number of commercial and special steels.

An Equation Representing the Rate of Development of Rust on Galvanized Iron Sheets as Estimated by the A.S.T.M. Test. J. B. Austin, United States Steel Corp.

An equation has been derived which represents, within the accuracy of observation, the change of rate of rusting on galvanized iron sheets with change in environment and change in weight of zinc coating as estimated by the tests carried out by Subcommittee VIII of Committee A-5 at four northern stations.

This relation suggests a method of plotting the data to give a straight line and enables one to derive an empirical number which can be used as an index of the corrosiveness of a given atmosphere to galvanized iron sheets when the test is made by the A.S.T.M. procedure.

Thursday, June 26 — 8 p.m. — Fifteenth Session

Held Simultaneously with Fourteenth Session

Cementitious Materials, Building Materials

Report of Committee C-16 on Thermal Insulating Materials. J. H. Walker, Chairman.

This committee, since its organization in 1938, has completed its first group of test methods which are being recommended for publication as tentative. Procedures developed for preformed block thermal insulation cover tests for crushing and flexural strengths, and a set of definitions for both block insulation and thermal insulating cement have been prepared. Detailed procedures have also been developed for mixing thermal insulating cements and complete methods of test for covering capacity and volumetric change upon drying for thermal insulating cements, and a test for bulk density of thermal insulating cement. A new method of test for determining the thickness and density of blanket type thermal insulating materials has also been prepared.

Further study is being given to the method of test for the determination of thermal conductivity by use of the guarded hot plate method developed by the joint committee composed of representatives from four interested organizations.

Report of Sectional Committee A42 on Specifications for Plastering. W. R. McCornack, Chairman.

Report of Committee C-7 on Lime. N. C. Rockwood, Chairman.

This progress report discusses briefly the considerations being given by the committee to a possible revision of the present standard as a result of changes in the processing of hydrated limes, the assembly and study of existing data on lime in mortar, mortar strength tests, procedures for determining available lime, analytical methods for arsenic, fluorine, and lead in lime, methods for slaking quicklimes, and the settling rates of lime products. Reference is made to a series of 23 proposed definitions for lime and lime products prepared during the year and now being reviewed by the committee.

Report of Committee C-11 on Gypsum. L. S. Wells, Chairman.

In order to bring the standard specifications for gypsum partition tile or block into agreement with the present FSB specification, revisions have been made and the revised specifications are recommended for immediate adoption as standard. Appended to the report as information is a description of the ammonium acetate method for determining purity of gypsum and calcined gypsum. A revision for immediate adoption comprising a change in the requirements for form and size is recommended in the standard specifications for gypsum; the existing tentative revision of this standard is also recommended for adoption.

Report of Committee C-1 on Cement. P. H. Bates, Chairman.

The new specifications issued last year embracing five types of portland cement are being further revised and recommended for adoption as standard. The new standard will replace the present standard specifications for portland cement and for high-early-strength portland cement. A number of minor changes are also being recommended in the tentative method for turbidimeter fineness tests of portland cement. Several editorial changes in the tentative methods of chemical analysis of cement are also included.

The report discusses the important work under way on studies of alkalies (free lime, sulfide sulfur, Na_2O and K_2O) in cement. Brief reference is also made to the work of the committee in studies of volume change and soundness, a physical test for sulfate resistance, use of vibration method for strength specimens, consistency, additions and tests for additions to cement, and portland-pozzuolana and masonry cements. The inspection work completed by the Cement Reference Laboratory during the year is briefly summarized. Fineness test data obtained by cooperative studies in ten laboratories on five portland cements using the air permeability method are included.

An Improved Hydrometer Method for Use in Fineness Determinations. Alexander Klein, University of California.

Describes a method of test and a hydrometer with a new type of scale which have been developed for measuring the fineness of powdered materials. The hydrometer scale consists of units of surface area rather than the customary units of density. The method of test is generally similar to that customarily used with fineness hydrometers, but employs various modifications which have been developed for tests of materials such as portland cement. Results of tests obtained with this hydrometer are compared with corresponding results obtained through the use of the A.S.T.M. tentative standard method.

Report of Committee C-8 on Refractories. J. D. Sullivan, Chairman.

This report recommends for adoption as standard a number of specifications and tests now published as tentative as well as several pending revisions. There are twelve tentative standards proposed for formal adoption comprising four specifications for refractories, the classification of fireclay refractories, six test methods, and the definitions of terms. The revisions to be adopted affect the classification of insulating block and fire brick, the specifications for ground fire clay, and symbols for heat transmission.

The report briefly discusses the progress of work under way on comparative studies of gas, fire, and electric furnaces for determining P.C.E. of refractory materials; preparation of a bibliography on slagging; and comparative studies under way on thermal conductivity of insulating fire brick. The specification subcommittee has in preparation requirements for fire clay plastic refractories for boiler, furnace, and incinerator service, ground fire clays for patching and daubing mixes, and for air-setting mortars.

Report of Committee C-14 on Glass and Glass Products. G. W. Morey, Chairman.

This report presents a proposed definition of "glass" prepared after a thorough study of existing nomenclature. Proposed methods for chemical analysis of soda-lime glass is presented for publication as tentative. A brief summary of the progress being made by the subcommittees on studies of chemical analysis and chemical properties of glass, and on the physical, mechanical, and thermal endurance of glass and glass products is also included.

Report of Committee C-12 on Mortars for Unit Masonry. J. W. McBurney, Chairman.

Presents as tentative new specifications for mortar for reinforced brick masonry prepared as a result of extensive data obtained from research studies both in the United States and abroad and from observations of field practice on the West Coast where this type of masonry is used extensively. The report presents a brief summary of considerations being given by the committee to the development of methods of test for mortars, to admixtures for mortar, and to revisions of the specifications for aggregate for masonry mortar.

Report of Committee C-18 on Natural Building Stones. W. C. Clark, Chairman.

Discusses the program of work outlined for this recently reorganized committee. Included are new proposed tentative definitions for rock, stone, granite, limestone, marble, and sandstone. The committee is recommending the withdrawal, pending further work, of the present tentative methods of sampling, tension testing, and for compressive strength of natural building stone, as well as the definitions of terms relating to natural building stone.

Report of Committee C-15 on Manufactured Masonry Units. D. E. Parsons, Chairman.

This report includes new proposed tentative specifications for vitrified clay filter block for use in trickling type filters. The tentative revisions submitted last year are recommended for adoption as standard in the specifications for structural clay load-bearing wall tile and for non-load-bearing tile. The freezing-and-thawing test for brick is being recommended for adoption as standard with two other changes in the general test methods for building brick.

Effect of Freezing Temperature in Freezing-and-Thawing Tests of Brick. Joseph C. Richmond and John W. McBurney, National Bureau of Standards.

Reports the effect on the resulting disintegration of two samples of half bricks of freezing and thawing for 50 cycles using freezing temperatures of 20 F. and −20 F., respectively. These two samples were formed by breaking bricks of a single sample into half bricks. The sample included a picked group of bricks formed by the dry-press, soft-mud and stiff-mud processes and was similar to samples tested in 1938.

Friday, June 27 9.30 a.m. Sixteenth Session

Held Simultaneously with Seventeenth Session

Concrete and Concrete Aggregates
Sanford E. Thompson Award

Report of Committee C-13 on Concrete Pipe. Theodore Doll, Chairman.

This committee is recommending the adoption as standard of three tentative specifications for concrete pipe issued last year as proposed revisions of the existing standards, without revision in the case of the specifications for concrete sewer pipe, but with additional revisions in the case of the specifications for reinforced concrete culvert pipe and reinforced concrete sewer pipe.

Papers for Revised Report on Significance of Tests of Concrete and Concrete Aggregates.

The Report on Significance of Tests of Concrete and Concrete Aggregates sponsored by the Society's Committee C-9 on Concrete and Concrete Aggregates was published by the Society in 1935. Work on a revision of this report is now under way in order to bring it up-to-date. The revision of each section has been assigned to individual authors. The following five sections have already been completed and are being presented at this annual meeting in order to have the benefit of discussion:

Size, Shape, Surface Texture, and Grading of Aggregates. H. J. Gilkey, Iowa State College.

Discusses the relationship of size, shape, surface texture and grading of aggregate particles to the needed characteristics of concrete; calls attention to such tests and test methods as are available for evaluating or measuring them and explains such specification clauses as might otherwise be subject to misinterpretation. The paper contains comparisons and illustrative material designed to promote both an understanding and a broader grasp of basic concepts and interrelationships between the concrete and some of the essential qualities of its inert constituents.

Density and Unit Weight of Concrete. M. A. Swayze, Lone Star Cement Corp.

The term "density of concrete" is defined. The effect of additions to cement which increase air content of concrete is discussed. Methods for calculation of concrete density, air content and net water content from laboratory and field data are suggested. The use of a temperature correction to the unit weight of water in determinations of unit weights of concrete is also recommended.

The Mineral Composition of Aggregates. H. F. Kriege, The France Stone Co.

Mineral composition affects the physical properties of aggregates to perhaps a greater extent than any other characteristic of the materials. The relation of the mineral composition of the major constituents to the significant physical properties of soundness, toughness, resistance to abrasion, particle shape, surface texture, absorption, etc., is discussed. Likewise, the behavior of minor mineral constituents as deleterious substances is described. A table is included giving the significant physical properties of the minerals commonly occurring in the commercial aggregates of blast furnace slag, crushed stone and gravel, as well as some of the special aggregates. A bibliography is included.

Cement Content of Hardened Concrete. H. F. Kriege, The France Stone Co.

The recent literature dealing with the analysis of hardened concrete is briefly reviewed. A comparison is made between the A.S.T.M. method C 85 – 36 and the later Australian and German Standard Methods. The results of a questionnaire sent to the leading commercial and highway testing laboratories in the United States to determine the utilization and significance of C 85 – 36 are presented in tabular form and discussed. Certain recommendations are made to increase the applicability of the present method.

Permeability and Absorption of Concrete. M. O. Withey, University of Wisconsin.

Deals with present uses for absorption and permeability tests on concrete and concrete products. Definitions of terms, the essentials of various procedures, the limitations of the commonly used 24-hr. cold and 5-hr. boil absorption tests, and the possibilities of other types of absorption tests are considered. The different ways in which water passes through concrete, the essence of the methods used for testing each, the limitations, and the significance of permeability tests are discussed.

Report of Committee C-9 on Concrete and Concrete Aggregates. F. H. Jackson, Chairman.

Included in this report also are completely revised specifications for ready-mixed concrete which include a number of improvements brought about in part by progress in the industry and increasing demands for this material. Revisions are also presented in the specifications for light weight aggregate for concrete, and in the Los Angeles abrasion test, and the soundness test for aggregates by use of sodium or magnesium sulfate.

Sanford E. Thompson Award.

To W. T. Thomson, Assistant Professor, Department of Applied Mechanics, Kansas State College.

The Second Sanford E. Thompson Award will be made to W. T. Thomson, Assistant Professor, Department of Applied Mechanics, Kansas State College, for his paper on "A Method of Measuring Thermal Diffusivity and Conductivity of Stone and Concrete,"

presented before the Society at the 1940 Annual Meeting. The Sanford E. Thompson Award was established in 1938 by Committee C-9 on Concrete and Concrete Aggregates as an annual token of recognition to the author or authors of a paper of outstanding merit on concrete and concrete aggregates presented at an annual meeting of the Society. The award is named in honor of the first chairman of the committee.

The Effect of Capping Methods and End Conditions Before Capping upon the Compressive Strength of Concrete Cylinders. G. E. Troxell, University of California.

Compression tests have been made on 768 cylinders of carefully controlled concrete to determine the effect of various types of capping materials upon the compressive strength of the cylinders. The capping materials used included: (1) Hydrostone, a high-strength gypsum product; (2) Castite, a sulfur-silica mixture; (3) oiled steel shot; (4) dry steel shot; and (5) plaster of paris tested at ages of $^1/_2$ and 1 hr.

As the end conditions of the concrete cylinders before capping were likely to affect the results obtained, four definite end conditions were selected for investigation. These included (1) plane ends normal to the axis of the cylinder, (2) plane ends not normal to the axis, (3) convex ends, and (4) concave ends. Tests were made on cylinders of a medium and a high-strength concrete.

Of the five capping methods used, the last three listed gave lower test results than the first two, the differences being especially large for other than plane ends normal to the axis of the cylinders.

"Creep" or "Flow" of Concrete Shown to Be an Elastic Action Due to Nonuniform Shrinkage, Under Working Load Conditions. G. A. Maney, Northwestern University.

Experimental evidence will be presented to support the statement that "plastic flow" or "creep" which have been considered to be the inelastic time yields of concrete under load, are negligible when concrete is loaded under low-stress conditions of ordinary practice. This evidence will show that what has for 30 yr. been considered an inelastic change due to load is an elastic change due to nonuniform shrinkage. This law of nonuniform shrinkage accounts for all of the excess time yield in loaded over unloaded cylinders which has for so many years been called "creep" or "plastic flow."

A Device for Studying the Workability of Concrete. T. C. Powers and E. M. Wiler, Portland Cement Assn.

The terms workability and consistency refer to complex qualities not capable of direct measurement. However, they do represent the combined effects of several properties that are measurable in fundamental units. The most important of these properties are believed to be: (1) the yield value; (2) the characteristic response to forces exceeding the yield value; and (3) the capacity of the material for plastic distortion, that is, the maximum possible distortion without dilatancy. A machine has been developed along the lines suggested by this hypothesis. It is capable of distoring a plastic mass at any desired rate and of giving an autographic record of the rate, the acting force and the degree of distortion. This device is designed for a laboratory study of paste, mortar and concrete mixes.

Discussion of the Sonic Methods of Testing Concrete. Leonard Obert and Wilbur I. Duvall, Bureau of Mines.

The paper discusses (1) the theoretical considerations underlying the sonic methods of testing concrete, (2) different methods of testing and the apparatus required, (3) effect of moisture and temperature, and (4) the optimum size of specimen.

Miscellaneous Business.

Friday, June 27 9.30 a.m. Seventeenth Session

Held Simultaneously with Sixteenth Session

Iron

Report of Committee A-6 on Magnetic Properties. Thomas Spooner, Chairman.

This report discusses the progress of the interlaboratory test on incremental permeability measurements. The results obtained in the alternating-current permeability and core loss tests on small Epstein samples are also discussed. The tentative method of test for measuring interlamination resistance and lamination factor of iron and steel is recommended for adoption as standard as is also the tentative revision of the standard definitions which comprise units and symbols relating to magnetic testing.

Measurement of Core Loss and A-C. Permeability with the 25-cm. Epstein Frame. S. L. Burgwin, Westinghouse Research Laboratories.

During the past 7 yr. a method of testing 1-lb., 28-cm. Epstein samples for core loss and a-c. permeability has been developed and used at the Westinghouse Research Laboratories. This method and the apparatus required are described in detail. A brief discussion is given of the limitations of the test method and some of the precautions to be observed. The test is of particular interest where uniformity is such that large test samples are unnecessary, or where research is the primary object.

Informal Report of Sectional Committee A21 on Specifications for Cast-Iron Pipe and Fittings. T. H. Wiggin, Chairman.

Report of Committee A-7 on Malleable Iron Castings. F. L. Wolf, Chairman.

This progress report recommends that in the committee's specifications for malleable iron castings the term "yield point" wherever it appears be changed to read "yield strength" in order to bring the nomenclature in line with accepted practice, this change to be made in 1942 when the next Book of Standards is issued.

Report of Committee A-3 on Cast Iron. J. W. Bolton, Chairman.

A proposed tentative recommended practice for evaluating the microstructure of graphite in gray iron, prepared jointly with the A.F.A. Gray Iron Division is presented for publication. A number of photomicrographs are included together with a graphite flake type chart and a graphite flake size chart as basic reference standards for gray cast iron. A detailed report describing the cooperative studies by the A.S.T.M. and A.F.A. subcommittees is also included.

The report presents proposed revisions in the standard specifications for automotive gray-iron castings and recommends the adoption as standard of the tentative specifications for cast-iron pit-cast pipe for water and other liquids. A summary of the progress of subcommittee activities is also included.

The Strain Hardening of Gray Cast Iron. John Sanford Peck, College of the City of New York.

Discusses the effect produced on Rockwell hardness of gray cast iron by increasing compressive loads. The data show that up to 40,000 psi. hardness increases slightly. From 40,000 to 60,000 psi. no significant change is observed. From 60,000 psi. to failure the hardness decreases rapidly.

To explain this apparent violation of the theory of strain hardening micrographs were made in the same spot in one specimen after the increasing compressive loads had been applied. These micrographs show minute cracks after a load of 60,000 psi., which cracks increase after succeeding loads until failure. It is concluded that the apparent softening of the metal is due to the penetrator of the tester slipping into one of these minute fissures and giving a lower reading.

Fatigue and Static Load Tests of a High-Strength Cast Iron at Elevated Temperatures. W. Leighton Collins and James O. Smith, University of Illinois.

Repeated load and short-time static load tests of unnotched and notched specimens cut from large plates of one heat of a commercial high-strength cast iron and tested at temperatures ranging from room temperature to 1200 F. are reported. A circumferential V-groove had practically no effect on the static ultimate strength and a small transverse hole had no significant effect on the endurance limit provided the net cross-section is used in computing stresses. The ratio of endurance limit to static tensile strength had an almost constant value of 0.44 for the entire range of temperature.

Young's Modulus of Elasticity and Some Related Properties of Graphitic Materials. H. A. Schwartz and C. H. Junge, National Malleable and Steel Castings Co.

Young's modulus of elasticity and density of a series of iron-carbon alloys are determined. A close correlation of Young's modulus and density in the presence of nodular graphite is demonstrated which extends to graphite content if no recombination of carbon has occurred in the solid state. Empirical equations for resistivity and coercivity in these materials are developed.

Miscellaneous Business.

New Index to Literature on Spectrochemical Analysis

THIS BIBLIOGRAPHY, prepared by W. F. Meggers and B. F. Scribner, of the National Bureau of Standards, is issued under the sponsorship of the Society's Committee E-2 on Spectrographic Analysis. It covers all important contributions to the literature on spectrochemical analysis since the first development of methods of sufficient accuracy and reliability to serve as a basis for the commercial inspection of materials. The first edition (1920–1937) contained 956 references. This second edition increases the number of references to 1467. The last two years, 1938 and 1939, account for 367, and 144 have been added to the earlier years.

This compilation is intended to be as complete as possible, by comparing it with all available bibliographies, and by searching abstract journals and the annual subject indices of many of the scientific and technical journals. Some additions are due to the inclusion of references to improved descriptions of atomic spectra, to studies of light sources and excitation processes, and to conditions influencing the accuracy of quantitative determinations. With the purpose of making the detailed Index of Subject Matter still more useful, it has been enlarged by listing new subjects and by giving more cross references.

This pamphlet, comprising 94 pages, may be secured from A.S.T.M. Headquarters for $1.00; A.S.T.M. members' price, 75 cents.

Spanish Translation of Refractories Standards

INCREASING EMPHASIS on our relations with the Pan-American countries has resulted in the translation into Spanish, under the sponsorship of the American Refractories Institute, of thirteen of the Society's specifications and methods of test covering refractory materials. Refractories for heavy duty and moderate duty stationary boiler service and for incinerators, and the methods for testing these refractories, are covered.

These Spanish translations of C-8 standards on refractory materials have been published as a compilation entitled "Manual de Normas A.S.T.M. para Materiales Refractorios," which is available from the American Refractories Institute, Oliver Building, Pittsburgh, Pa. A limited number of copies of this 44-page manual are also available from A.S.T.M. Headquarters at 25 cents per copy.

Eimer & Amend Acquire New Plant

FOUNDED IN 1851, at the corner of Third Avenue and Eighteenth Street, Eimer & Amend has been a landmark in New York City for 90 years. Recently the company purchased a new and larger plant at the corner of Greenwich and Morton Sts., on the West Side of Manhattan. The new plant consitutes a seven-story, completely fireproof building containing 180,000 sq. ft. of floor space.

Present plans contemplate equipping the new plant with modern offices, display rooms, glass blowing shops, engraving rooms, instrument shops, laboratories and chemical manufacturing equipment, as well as up-to-date equipment for the handling of the thousands of orders received each year. The new plant will be opened about September 1, of this year.

It has often been said that the growth of chemical technology has followed the development of new tools for the chemist. Eimer & Amend's preëminent position in the field of developing such tools will be further enhanced by their new quarters.

The Making, Shaping and Treating of Steel

MOST METALLURGISTS and technical men and engineers concerned with steel and steel products have at least a "thumbing" acquaintance with the publication entitled "The Making, Shaping and Treating of Steel" originally prepared by J. M. Camp and C. B. Francis, the fourth edition of which was issued in 1925. Just off press is the Fifth Edition of this very comprehensive volume issued by the Carnegie-Illinois Steel Corp., the book having been rewritten and greatly enlarged by Mr. Francis.

Any book reviewer may do three things: give a general picture of a publication; point to a few errors or misconceptions or faults which may be in the publication; or attempt an abstract. Some reviewers attempt to combine all three and the practice may vary depending upon the space available, but in the BULLETIN we cannot attempt an abstract of so voluminous a publication and it would be a dangerous practice, too. We are not inclined to point to minor discrepancies in any publication, unless it would be of service to the members to do so. We feel that a general description of the book would be of most service to help members determine whether the book would be of value to them.

Based on knowledge and use of earlier editions, we do not hesitate to recommend to any metallurgical engineer no matter how much of an authority he may be, to any technical man in the steel industry, to the student engineer, and to the executive or individual concerned with the purchase and use of steel products, that he obtain and spend as much time as possible with this book.

The arrangement of the Fifth Edition follows that of the earlier ones which has proven satisfactory. It is divided into four parts, each of which is subdivided into chapters and sections, and Mr. Francis has attempted to make each portion as independent of others as is feasible so that it is adapted for the individual who is concerned with some particular product or wishes to read only about a particular subject without a great deal of time spent in cross reference or study of other sections.

The four main divisions of the book and some of the specific chapters in each are as follows:

PART I—THE MAKING OF STEEL: Fundamentals of physics, chemistry, metallurgy; refractories; iron ores; fuels; fluxes and slags; manufacture of pig iron; manufacture and uses of wrought iron and sponge iron; early methods for making steel; modern steels and special processes; the Besse-

mer process; the open-hearth processes; manufacture of steel in electric furnaces; and the duplex and triplex processes.

PART II—THE SHAPING OF STEEL: Summary of methods for testing steel; shaping steel by casting; mechanical treatment of steel; essentials of rolling mill construction and operation; preparation of the steel for rolling; rolling of steel ingots to blooms, billets and slabs; rolling of billets and other semifinished products for rolling; rolling of finished products—plates; rolling of large sections; light narrow flats and merchant mill products; circular shapes; and forging of axles, shafts, and other shapes.

PART III—COMPOSITION AND HEAT TREATMENT OF STEEL: Structural constituents developed in the heat treatment of plain carbon steels; heat treating theory and practice; constituent and controlling elements of carbon and low-alloy steels; low-alloy high-strength structural steels; pearlitic, or medium alloy steels, containing one alloying element; medium, or pearlitic and ferritic, alloy steels containing more than one alloying elements; high-alloy steels—austenitic and ferritic steels containing one alloying element; high-alloy steels—austenitic and ferritic steels containing more than one alloying element; tool and special alloy steels.

PART IV—MANUFACTURE OF STEEL WIRE, SHEET, STRIP AND TUBULAR PRODUCTS: Gages; manufacture of steel wire and steel wire products; manufacture of hot-rolled strip and sheet; cold-rolled strip and cold-reduction mills; protective coatings for sheets and strip; and manufacture of steel tubular products.

At the end of each chapter (not Part, but *Chapter*) are given selected references which should prove helpful to those who wish to investigate certain subjects or branches of steel making, shaping or treating, more fully. A large number of these references are to A.S.T.M. publications, papers, reports, and standards.

Because of the particular interest to many members of the Society, reference should be made to the chapter covering "A Summary of Methods for Testing Steel," comprising some 70 pages. It should also be of interest to those engaging in testing and inspection of metals in connection with national defense activities. Special mention might be made of the illustrations, there being 556 numbered figures including many excellent halftones and curves. The number of tables, not included in the 556 figures, approximate 200.

For those men, and there are probably many, who would like to get a working knowledge of the manufacturing processes, in a relatively short time, this part of the book (IV), about 350 pages, is particularly good.

The value of any publication is enhanced by a carefully prepared index. Mr. Francis has rightly spent considerable time on what is termed a "word index" which covers some 60 pages.

This book appears to us to be an excellent investment at $7.50. Copies can be obtained from the Carnegie-Illinois Steel Corp., William Donald, Comptroller, 435 Fifth Ave., Pittsburgh, Pa.

Papers on Effect of Temperature on Metals

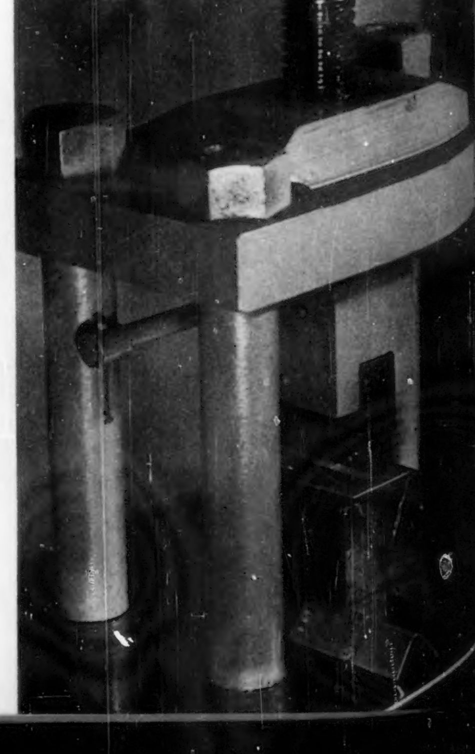
AT THE DECEMBER, 1940, Annual Meeting of the American Society of Mechanical Engineers several papers were presented dealing with work of the Joint Research Committee on Effect of Temperature on the Properties of Metals in line with the committee's practice to present at meetings of the two societies (A.S.M.E and A.S.T.M.) which sponsor the group, various reports and papers covering aspects of the researches. The two societies cooperate by furnishing each other copies of the material for limited distribution. A.S.T.M. members can obtain without charge a copy of the following two papers which were preprinted: "A High-Temperature Bolting Material," by A. W. Wheeler, and "Effect of Grain Size and Structure on Carbon-Molybdenum Steel Pipe for High Temperature Steam Service," by A. E. White and Sabin Crocker. A very limited supply is available of the Progress Report on Tubular Creep Tests, by F. H. Norton, and the Report on Interpretation of Creep Tests on Tubes, by C. R. Soderberg. Copies will be sent as long as the supply lasts.

Paint Papers Available

MEMBERS OF THE Society are advised that two of the papers presented at the March meetings of Committee D-1 on Paint, Varnish, Lacquer, and Related Products, in Washington can be procured from the Secretary of the Technical Committee of the New York Paint and Varnish Production Club. Orders should be addressed to the Secretary, Carl L. Engelhardt, at 35 Nostrand Ave., Brooklyn, N. Y. These two papers which created a great deal of interest are "Methods for Producing Uniform Films" by A. O. Allen, and "Quantitative Adhesion Measurement of Coatings Before and After Exposure" by R. D. Bonney. A limited number of the two papers are available at 50 cents per copy.

Reprints of Symposiums on Analytical Chemistry and Spectrographic Analysis

WIDESPREAD INTEREST in the Symposium on Tools of Analytical Chemistry, the six papers comprising it having appeared in the January, 1941, BULLETIN, and the several papers and discussions published in the March, 1941, BULLETIN, comprising the Symposium on Spectrographic Analysis has led to the reprinting of this material in combined form. Copies of the 56-page reprint can be obtained from A.S.T.M. Headquarters at 50 cents per copy. All those concerned with these two fields who do not have the BULLETINS readily available should find it desirable to have a copy of this reprint in their files.



"Bend Test for Thin High Tensile Metal"

Awarded honorable mention, amateur class, in the Third A.S.T.M. Photographic Exhibit; submitted by A. G. Dean, E. G. Budd Mfg. Co.

Cut Courtesy Budgette

NEW MEMBERS TO APRIL 24, 1941

The following 48 members were elected from March 17 to April 24, 1941:

Company Members (7)

Brand and Co., William, W. Naumburg, Jr., Partner, 276 Fourth Ave., New York City.

Cia. de Cemento "La Cruz Azul," S. C. L., Arcadio Hernandez, General Manager, Ave. Independencia 80, Mexico, D. F., Mexico.

Cosmos Imperial Mills, Ltd., A. F. Knight, General Superintendent, Sherman Ave. North, Hamilton, Ont., Canada.

Electro Manganese Corp., C. L. Mantell, Consulting Engineer, 601 W. Twenty-Sixth St., New York City.

Michiana Products Corp., H. Klouman, Vice-President, Lock Box 302, Michigan City, Ind.

Ohio Brick and Tile Inst., Inc., Hal W. Jones, Regional Engineer, 306 Market Ave. North, Canton, Ohio.

Standard Ultramarine Co., The L. E. Squire, Assistant Technical Director, Huntington, W. Va.

Individual and Other Members (38)

Beardmore, F. J., Manager, The Commonwealth Portland Cement Co., Ltd., 4 O'Connell St., Sydney, Australia.

Berry, A. H. G., Chairman, Board of Directors, Super Cement, Ltd., 29 Tavistock Square, London, W. C. 1, England.

Daniel, M. C., Engineer in Charge, The Virgin Islands Co., Box 230, Christiansted, St. Croix, Virgin Islands.

Davis, F. W., Metallurgist, E. B. Badger and Sons Co., 75 Pitts St., Boston, Mass.

Doran, A. B., Vice-President, Western Research Laboratories, 819 N. LaBrea Ave., Los Angeles, Calif.

Fullerton, H. S., Chief Engineer, Baldwin-Southwark Division, The Baldwin Locomotive Works, Paschall P.O., Philadelphia, Pa.

Giffen, E., Director of Research, The Institution of Automobile Engineers, Research Dept., Great West Road, Brentford, Middlesex, England.

Graf, J. R., Sales Engineer, Baldwin-Southwark Division, The Baldwin Locomotive Works, Paschall P. O., Philadelphia, Pa. For mail: 123 Roseland Ave., Fox Chase Manor, Philadelphia, Pa.

Grant, H., Jr., Development Engineer, Walter Kidde and Co., Inc., 601 W. 156th St., New York City.

Guyer, P. B., Chief Metallurgist, Clairton Works, Carnegie-Illinois Steel Corp., Clairton, Pa.

Jackson, H. M., Superintendent, Pacolet Manufacturing Co., New Holland, Ga.

Kennedy, W. A., Supervisor of Products, General Fire Extinguisher Co., Providence, R. I. For mail: 31 Forest St., Providence, R. I.

Kronau, J. L., President, Eastern Highways Corp., Belle Grove Road, Brooklyn, Md.

Labarthe, Jules, Jr., Senior Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa.

Marino, A. J., District Manager and Engineer, P. R. Mallory Co., 6 E. Forty-fifth St., New York City.

Mayer, J. H., Chief Engineer, Alabama Asphaltic Limestone Co., Birmingham, Ala. For mail: 1318 S. Thirty-second St., Birmingham, Ala.

McCartt, K. C., Chemist, Universal Sanitary Manufacturing Co., Box 391, New Castle, Pa.

Meyer, H. J., Laboratory Director, Thurston Cutting Corp., Room 1105, 40 Worth St., New York City.

Miller, G. H., Owner and Manager, N. R. Miller and Co., 45 W. Richmond St., Toronto, Ont., Canada.

Moody, W. L., President, Sorbtex Foundation, Inc., Richmond, Va. For mail: 5 N. Sixth St., Richmond, Va.

Moore, W. W., Civil Engineer, Dames & Moore, 816 W. Fifth St., Los Angeles, Calif.

Mugfor, R. J., Chief Engineer, The Shaw-Kendall Engineering Co., 120 S. Superior St., Toledo, Ohio.

Nolan, J. L., Manager, Oil Dept., Farmers Union Central Exchange, Inc., Box G, St. Paul, Minn.

North Carolina State College, Textile School, Thomas Nelson, Dean of Textile School, State College Station, Raleigh, N. C.

Olson, H. M., Promotional Engineer, The Ohio Salt Co., Wadsworth, Ohio. For mail: 171 Longue Vue Drive, Mt. Lebanon, Pa.

Page, G. A., Jr., Chief Engineer, Curtiss-Wright Corp., St. Louis Airplane Division, Robertson, Mo.

Paine, R. E., Chief Metallurgist, Aluminum Co. of America, Pacific Coast Division, Los Angeles, Calif. For mail: 919 E. Philadelphia St., Whittier, Calif.

Poulsen, M. C., Secretary and Engineer, Port Costa Brick Works, Sixth and Berry Sts., San Francisco, Calif.

Rayborn, G. H., Chief Chemist, Southern Naval Stores Co., Columbia, Miss. For mail: 805 Alberta Ave., Columbia, Miss.

Rhee, Daniel, Technical Director, Carr Manufacturing Corp., Bristol, R. I. For mail: 875 Hope St., Bristol, R. I.

Rodgers, Rand, Vice-President Alton Brick Co., 3832 W. Pine, St. Louis, Mo.

Schenectady, City of, Department of Engineering and Public Works, M. M. Cohn, Sanitary and Testing Engineer, City Hall, Schenectady, N. Y.

Sherry, W. B., Manager, Technical Service Division, General Chemical Co., Edgewater, N. J.

Smoley, E. R., Process Engineer, The Lummus Co., 420 Lexington Ave., New York City.

Suhrie, G. B., Fabric Technician-Stylist, Fox, Wells & Warner, 450 Seventh Ave., New York City.

Ude, Hans, Manager, Verein Deutscher Ingenieure, Hermann Göring Str. 27, Berlin, NW 7, Germany.

Whitman, H. C., President, The Esmond Mills, Inc., 21 E. Twenty-sixth St., New York City.

Wilcoxon, Frank, Director, Control Laboratory, Ravenna Ordnance Plant, Atlas Powder Co., Delaware Trust Building, Wilmington, Del.

Junior Members (3)

Sneed, H. G., Materials Testing Engineer, Brown, Bellows & Columbia, Corpus Christi, Tex. For mail: U. S. Naval Air Station Dormitory, Corpus Christi, Tex.

Spicer, W. E., Jr., Procurement Officer, Chemical Warfare Service, U. S. Army, Chicago, Ill. For mail: 5528 Hyde Park Boulevard, Chicago, Ill.

Winski, T. C., 1915 Main St., Wellsburg, W. Va.

PERSONALS

. . . News items concerning the activities of our members will be welcomed for inclusion in this column.

J. K. Beeson, formerly Assistant Manager of Sales, Pittsburgh Steel Co., Pittsburgh, Pa. is now Vice-President, In Charge of Sales.

H. H. Morgan, Past-President of the Society, and formerly Manager, Rail and Fastenings Department, has been appointed Chief Engineer, Robert W. Hunt Co., Chicago, Ill. He will still retain active management of the Rail and Fastenings Department.

Thomas Spooner, is now Manager, Central Engineering Laboratories and Standards Department, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. He was formerly Manager of the Research Laboratories.

H. J. Huester, who was Associate Materials Engineer (Metals), U. S. Navy, Bureau of Aeronautics, Washington, is now Technical Adviser, Reynolds Metals Co., Inc., Washington, D. C.

C. H. Splitstone, formerly Superintendent of Construction, Erie Railroad Co., Cleveland, Ohio, is now Assistant Chief Engineer, for the same company.

L. C. Wilson, General Manager, Reading-Pratt & Cady Division, and the Reading Steel Casting Division of American Chain & Cable Co., has been awarded the Lorenz medal by the Steel Founders Society of America.

D. E. Parsons, Chief, Masonry Construction Section, National Bureau of Standards, Washington, D. C., has been appointed chairman of the new Publications Committee of the American Concrete Institute. This committee is a consolidation of the former Program Committee, which the A.C.I. Board of Direc-

tors has dissolved, and the Publications Committee, thus concentrating in one group activities in connection with the development of the program and publications. Other A.S.T.M. members serving on this committee with Mr. Parsons include: R. W. Crum and R. E. Davis (serving, under the Rules, so long as they remain in their capacities as chairmen of the Standards and Advisory Committees, respectively); R. F. Blanks, and R. W. Carlson (each of them newly elected members of the Board), to June, 1943; F. H. Jackson, H. J. Gilkey and R. B. Young, to June, 1943.

At the annual convention of the American Concrete Institute, the following A.S.T.M. members were elected to office: R. E. Davis, University of California, to succeed himself as Vice-President; M. O. Withey, University of Wisconsisn, promoted from the office of Director-at-Large to a Vice-President; R. W. Carlson, Massachusetts Institute of Technology, as First District Director; Stanton Walker, National Sand and Gravel Association, elected to succeed himself on the Board of Direction; J. W. Kennedy, Huron Portland Cement Co., as Director, Fifth District; R. F. Blanks, U. S. Bureau of Reclamation, as Director, Sixth District. R. W. Crum, National Research Council, originally appointed to fill a vacancy in the position of Director-at-Large, was this year elected to succeed himself for a three-year term in that office; and D. E. Parsons, National Bureau of Standards, has been named a member of the Board of Direction to fill a vacancy.

John Ekern Ott, Mechanical Engineer, Acme Steel Co., with general offices at 2840 Archer Ave., Chicago, has recently been appointed manager of the Archer Plant of the company.

At the forthcoming annual convention of the American Foundrymen's Association, the following will receive Medal Awards: C. E. Hoyt, Executive Vice-President and Manager of Exhibits, American Foundrymen's Association, the Joseph S. Seaman Medal for his outstanding service to the foundry industry; F. L. Wolf, Technical Director, Ohio Brass Co., the John A. Penton Gold Medal, for his outstanding contributions to the non-ferrous and malleable foundry industry; and Max Kuniansky, General Manager, Lynchburg Foundry Co., the W. H. McFadden Medal for outstanding contributions to the gray iron industry and the A.F.A. The A.F.A. Awards Board consists of the last seven living past presidents, and of the seven, the following are members of A.S.T.M.: Hyman Bornstein, Director of Laboratories, Deere and Co.; and J. L. Wick, Jr., President and General Manager, Falcon Bronze Co. R. J. Allen, Consulting Metallurgist, Worthington Pump and Machinery Corp., has been nominated for director of the A.F.A.

At the annual meeting of the American Institute of Mining and Metallurgical Engineers, D. K. Crampton, Research Director, Chase Brass and Copper Co., Inc., was elected chairman of the Institute of Metals Division for the coming year. R. L. Hallett, Chief Chemist, National Lead Co., who served as Vice-Chairman of the New York Section for 1940–1941, will be Chairman for 1941–1942.

P. D. Merica, Vice-President and Director, The International Nickel Co., was recently presented with the Platinum Medal of the Institute of Metals of Great Britain, in recognition of "distinguished service to non-ferrous metallurgy." The presentation was made at the British Embassy, Washington, by Lord Halifax, the then recently arrived British Ambassador. Doctor Merica is the third recipient of this medal. On February 10, Doctor Merica presented before the Washington Chapter of the American Society for Metals the first George Kimball Burgess Memorial Award Lecture, established as a tribute to Doctor Burgess and his outstanding contributions to the science of metallurgy.

The Franklin Institute has announced that its Louis E. Levy Medal, awarded annually "to the author of a paper of especial merit, published in the *Journal* of The Franklin Institute, preference being given to one describing the author's experimental and theoretical researches in a subject of fundamental importance" will be presented this year to J. M. Lessells, Associate Professor of Mechanical Engineering, Engineering Department, Massachusetts Institute of Technology, and C. W. MacGregor, Associate Professor, M.I.T., for their paper "Combined Stress Experiments on a Nickel-Chrome Molybdenum Steel." Professor Lessells, a native of Scotland where he received his engineering education, was for a number of years Manager of the Mechanical Division, Research Laboratories, Westinghouse Electric and Manufacturing Co., and then was Engineering Manager of the South Philadelphia Works. Professor MacGregor was formerly Research Engineer, Westinghouse Electric and Manufacturing Co. He has been at M.I.T. since 1934, where he was Instructor, Mechanical Engineering, until 1937, when he was appointed Assistant Professor.

Catalogs and Literature Received

C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. The new TAG Oil Testing Instrument Catalog, No. 699E, covers many of the latest developments in this field. There are 30 pages of pertinent details with excellent illustrations of the very extensive equipment produced by this company, including TAG etched stem thermometers, enclosed scale thermometers, and hydrometers for general laboratory use. There is given a guide to the principal tests of petroleum products listing the A.S.T.M. methods and government methods wtih TAG apparatus itemized. A helpful feature of the catalog is the brief description of the materials grouped in various sections. An alphabetical index is provided.

Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Catalog E-54(4), entitled "Bushing Test Set," a twelve-page booklet describing an entirely new portable equipment for measuring, at a normal test voltage of 10,000 volts, the power factor and capacitance of installed bushings, insulators, and other high-voltage dielectrics. Illustrated.

Cooley Electric Manufacturing Corp., 215 S. Senate Ave., Indianapolis, Ind. A five-page folder, Catalog 40, entitled "Electric Heating Equipment," describing muffle furnaces, pyrometers, rheostats, hotplates, and combustion tube furnaces.

Burrell Technical Supply Co., 1936 Fifth Ave., Pittsburgh, Pa. A 32-page folder, Catalog F-241, covering high-temperature furnaces, including the Burrell "Little Giant" for temperatures up to 2500 F., the Box Type K, and many other models. Illustrated.